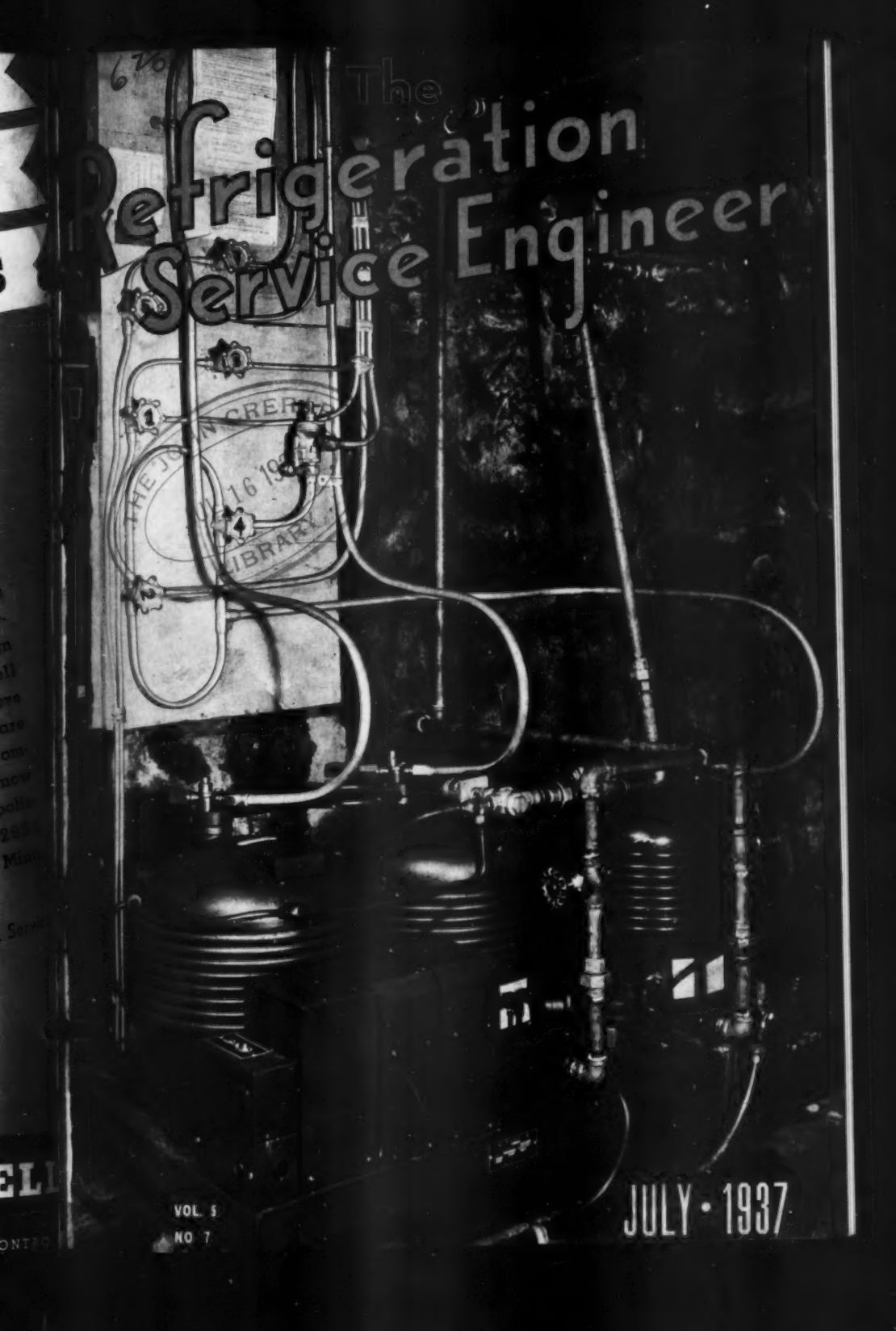
The
Refrigeration
Service Engineer
VOL. 5
NO. 7
JULY • 1937

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Coils are wrapped in moisture-resistant paper which protects the finish of the tubes.

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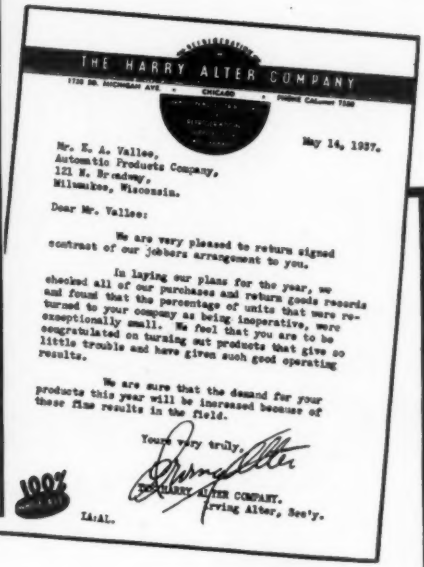

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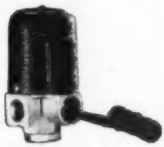

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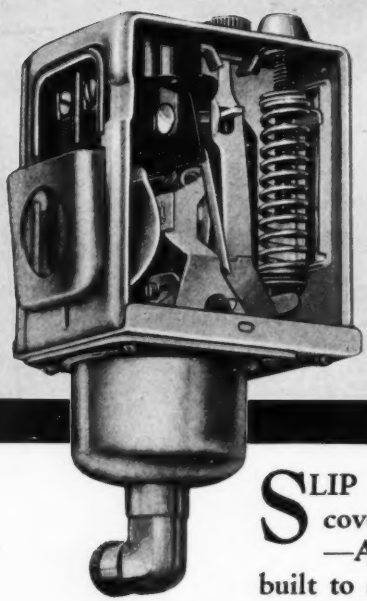

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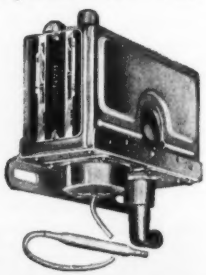

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Ranco INC. Columbus, Ohio

The Refrigeration Service Engineer

Vol. 5 No. 7

July, 1937

A Monthly Illustrated Journal Devoted to the Interests of the Refrigeration Service Engineer in the Servicing of Domestic and Small Commercial Refrigeration Systems and Oil Burners

Official Organ
REFRIGERATION SERVICE ENGINEERS SOCIETY

COVER

Showing a 1-hp. and a ½-hp. Westinghouse hermetically-sealed unit, installed by L. H. Udell & Sons, of Grand Rapids, Mich., in the Wilson Market at Sparta, Mich. A Fedders constant pressure valve can be seen on the panel board.

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The Refrigeration Service Engineer

VOL. 5, NO. 7 CHICAGO, JULY, 1937 $2.00 Per Annum

Estimating Commercial Refrigerator Loads

How to Determine Load Factors for Various Installations Is Shown

By L. K. WRIGHT, M.E.*

WHERE commercial refrigerators are to be estimated the "Ice Drip Test" is invaluable. It provides a positive check as to the refrigerating load under actual operating conditions, but can be employed of course only where the refrigerator is in use and is being cooled with ice.

With new refrigerators, designed for mechanical refrigeration, it is impossible to obtain ice melting data, since they never make use of ice. Again, we may be called upon to estimate a proposed refrigerator installation, which exists only upon paper. In such cases means other than the Ice Drip Test must be employed to determine the probable refrigeration load.

The following method of computing leakage and loads is quite similar to that used by Frigidaire and other large organizations, except it has a slightly more liberal allowance and permits the estimation of product loads in a simple manner.

Insulation

The products of reputable refrigerator manufacturers can be depended upon to contain at least the minimum thickness of insulation necessary for the particular use to which the box or cooler is to be subjected. Unknown refrigerators, or boxes with insulation of uncertain value, should be checked as to wall thickness and amount of insulation. The heat leakage through the walls of different makes of standard refrigerators varies but slightly for identical wall thicknesses.

Sheet cork, or corkboard as it is termed by the trade, is perhaps the one insulation which enjoys greatest use. As most refrigerators are lined with this material the following data is based on the use of sheet cork insulation. Where a different insulation is used the correction factors (given in Table II) can be employed to determine leakage through the box walls.

Heat Leakage Factors

The following table furnishes heat leakage factors for sheet cork of various thicknesses. It should be borne in mind that it is usual practice to have a 7/8 inch wood lining on each side of the insulation and this, in conjunction with several layers of odorless insulation paper, results in a total wall thickness approximately two inches more than the actual insulation thickness. Thus, a 5 inch wall will have a 3 inch insulation.

To determine insulation in walls of an existing box of unknown make, a 3/4 inch wood

* Chief Refrigeration Instructor, Y. M. C. A. Trade and Technical School, N. Y. C.

bit can be used to obtain samples. Plug the openings with cork stoppers and trim off flush with the refrigerator surface. If this is carefully done the result will be almost unnoticeable, especially if performed in an inconspicuous place.

TABLE I. HEAT LEAKAGE FACTORS FOR CORKBOARD

(In pounds I.M.E. per sq. ft. per 1° F. per day)

Thickness of Insulation, Inches	Total Wall Thickness	No Service	Light Service	Normal Service	Heavy Service
1	3	0.030	0.033	0.035	0.037
1½	3½	0.026	0.029	0.031	0.033
2	4	0.022	0.024	0.027	0.029
3	5	0.017	0.019	0.022	0.024
4	6	0.014	0.016	0.019	0.021
5	7	0.012	0.014	0.017	0.019
6	8	0.010	0.013	0.015	0.017
7	9	0.009	0.012	0.014	0.016
8	10	0.008	0.011	0.013	0.015

Service Factors

It will be observed that Table I is divided into four groups according to service or usage which is to be imposed on the refrigerator. Factors tabulated under "No Service" are used for estimating heat loads imposed on water or brine tanks which have no service load at all.

The "Light Service" factors are employed for fur storage and similar storage rooms having but little usage. These factors are also applicable to photographers' developing tanks, bottle coolers and tank milk coolers, but provide data for wall leakage only. Any product load must be added to the wall leakage to obtain total load.

"Normal Service" applies to florists' refrigerators, grocers' boxes and for meat coolers in stores where the preponderance of sales is from a display case or counter.

The factors under "Heavy Service" are for use in estimating refrigeration loads of restaurant and hotel boxes, meat coolers in stores where there are no display cases or counters and for special installations where high humidity is essential for proper storage of products.

Insulations Other Than Corkboard

The "Heat Leakage Factors" given in Table I refer to sheet cork insulation. For insulations other than corkboard use is made of the correction factors given in the following table. In Table II corkboard is taken as standard, with a value of 1.00, and the other common insulation materials are compared to it on this basis.

Thus, if a refrigerator is found insulated with mineral wool, the factor given in Table I would be multiplied by 1.06 and this corrected factor used in the estimate.

TABLE II. CORRECTION FACTORS FOR INSULATIONS OTHER THAN CORKBOARD

Insulation	Factor
Corkboard (Sheet Cork)	1.00
Mineral Wool	1.06
Rock Cork	1.20
Dry Zero (Dry Zero)	0.92
Insulite	1.09
Flaxlinum	1.12
Cabot's Quilt	1.13
Balsa Wood	1.20
Granulated Cork	1.45
Lith Board	1.35

Glass Surfaces

Where the glass surface is but a portion of one box wall it may be ignored. The average butcher and grocery box falls in this category. If the glass surface is more than one-third of the wall surface, such as occurs in some butcher boxes and is found generally the case with florists' refrigerators, the glass surface should be estimated for heat leakage. In such cases the total outside surface of the refrigerator is computed and the glass surface deducted, so that insulated surfaces can be estimated separately from the amount of glass surface. The two leakage loads are added together for total leakage load.

The glass surfaces are rated as given in Table III.

TABLE III. GLASS FACTORS

Plates of Glass	No Service	Light Service	Normal Service	Heavy Service
1	0.167	0.172	0.188	0.196
2	0.083	0.092	0.104	0.112
3	0.042	0.052	0.063	0.084

Example—Butcher Box

To make use of the tables, assume an 8 ft. x 9 ft. x 10 ft. butcher box, to be used in a store where most sales will be from a display case. The box insulation will be sheet cork of 3 inch thickness; total wall being approximately 5 inches. The highest summer temperature encountered in the par-

ticular territory will be placed at 90 degrees F. and customer desires a 40 degrees F. refrigerator temperature.

First determine the total outside refrigerator surface. This is computed:

(Two ends) .....$8 \times 10 \times 2 = 160$
(Two sides) .....$9 \times 10 \times 2 = 180$
(Top and bottom)...$8 \times 9 \times 2 = 144$

Total surface .....= 484 sq. ft.

As this case comes under the "Normal Service" listing, the factor for 3 inch corkboard will be found in Table I to be given as .022. The temperature difference under which the box will operate under extreme conditions will be: $90 - 40 = 50°$ differential.

The problem resolves itself into the following:

Total Sq. Ft. × Temp. Differential X Factor, or:

$484 \times 50 \times .022 = 532.4$ lbs. I.M.E. (ice melting effect) per day required.

Example—Florists' Cooler

In this example assume a refrigerator 90 inches x 38 inches x 76 inches insulated with 2 inches of mineral wool. In all cases the height is given last. (It will be observed that the dimensions are given in inches, therefore calculate square inches of outside surface and convert the result to square feet by dividing by 144.) One entire side (90 inches x 76 inches H) consists of glass, 3 thicknesses. The maximum room temperature will be assumed 100 degrees F. and the box temperature taken as 50 degrees F.

The outside insulated surface is first determined, being computed as:

(Two ends) .....$38 \times 76 \times 2 = 5{,}776$
(One side) .....$90 \times 76 \times 1 = 6{,}840$
(Top and bottom) $90 \times 38 \times 2 = 6{,}840$

19,456 sq. in.

This insulated surface divided by 144 gives 135.11 square feet.

The glass surface $= 90 \times 76 = 6{,}840$ square inches. Divided by 144 the square feet of surface is found to be 47.5 square feet.

Florists' refrigerators are rated as "Normal" service. Sheet cork, in Table I, has a value of 0.027. As the insulation in the box being estimated is not cork, but mineral wool, the "Correction Factor" in Table II, is referred to, being found to be 1.06.

The corrected factor for mineral wool of 2 inch thickness is therefore 0.027×1.06 or .02862.

Insulated surface leakage with a 50 degree T D, is:

$135.11 \times .02862 \times 50 = 193.35$ lbs. I.M.E. per 24 hr.

Glass surface leakage with a 50 degree T D, is:

$47.5 \times .063 \times 50 = 149.62$ lbs. I.M.E. per 24 hr.

Total leakage or heat load is therefore: $193.35 + 149.62$ or 342.97 lbs. I.M.E. per 24 hr.

Machine and Coil Size

In the case of the butcher box an I.M.E. of 422 lbs. was found to be needed per 24 hrs. As the coil and machine will not be in use continuously, so as to permit some idle periods, the equipment must be selected in accordance with the time allowed for operation per day. Assume a 16 hour operating time per 24 hour. The butcher box would require coilage and a machine whose rating would be:

$\frac{24}{16} \times 422$ or having a rating of 633 lbs. I.M.E. per 24 hr.

The florist box, if assumed to operate 20 hours out of the 24, would require coilage and machine having a capacity of:

$\frac{24}{20} \times 343$ or 411.6 lbs. I.M.E. per 24 hours.

Where the owner would indicate a desire for only 12 hours of operation the rating of machine and coil for the florist job would be:

$\frac{24}{12} \times 343$ or 686 lbs. I.M.E. per 24 hours.

Extra and Product Loads

Where refrigerators are subjected to extra loads these must be computed and added to the normal heat leakage and usage load, to obtain total load.

A man working in a butcher box throws off heat at a rate varying from 3.5 to 4 lbs. I.M.E. per hour.

Electric lights where used for continuous illumination or display must be considered. If only used to illuminate the refrigerator when entering the cooler and then turned off, such as by an automatic door switch, the heat load incident to such use can be ignored. Continuous illumination or lights used for display should be computed and added to the heat load imposed on coil and machine. The following table gives ratings in lbs. I.M.E.

TABLE IV. LOAD DUE TO ELECTRIC LIGHTS

Size	One Hr.	Per Day
25 Watts	0.59	14.2
50 Watts	1.19	28.5
100 Watts	2.38	57.0

The table given below is based on the amount of heat to be extracted from various food products in order to cool them 1 degree F. Recommended temperatures are also specified for each of the particular products.

TABLE V

HOLDING TEMPERATURES AND PRODUCT LOADS

	B.t.u. per lb. per 1° F.	Lb. Ice (I.M.E.) per 100 lb., per 1° F.	Recommended Temperature
Apples	.92	.63	38-40
Beef, lean	.75-.77	.52	38-42
Beef, fat	.60	.42	38-42
Beer	.90	.62	38-42
Brined Meats	.75	.52	35-40
Butter	.55	.38	38-45
Cream	.70	.49	35-40
Cider	.90	.62	32-40
Eggs	.76	.53	38-42
Fish (in ice)	.80	.55	32-38
Flowers	.80	.55	48-50
Furs (periodical freezing for 24 hrs.)	..	..	40-45
Hams, fresh, holding	.55	.38	30-35
Hams, fresh, retail	.55	.38	35-40
Ice Cream, brick	.80	.55	0-4
Ice Cream, bulk	.80	.55	6-12
Lard	.50	.35	40-45
Milk	.90	.62	35-45
Melons	.90	.62	32-35
Mutton	.60	.42	36-38
Oysters	.84	.59	33-40
Oranges	.90	.62	36-40
Pork Chops	.55	.38	42-44
Pork, holding	.55	.38	30-35
Pork, retail	.55	.38	35-40
Poultry, retail	.80	.55	35-40
Poultry, holding	.80	.55	28-32
Potatoes	.80	.55	33-40
Peaches	.82	.57	35-40
Pears	.80	.55	33-36
Tomatoes	.88	.61	34-35
Tenderloins, retail	.70	.49	35-40
Tenderloins, holding	.70	.49	30-35
Veal, retail	.70	.49	35-40
Veal, holding	.70	.49	30-35
Vegetables	.93	.65	33-40
Wines	.90	.62	40-45

Product Load

Where lights are used continuously or where excessive turnover of product is expected, these extra loads should be added and included in the total load. Freshly killed or warm products must be considered carefully, taking initial temperature and determining temperature differential so that the product load can be found.

The product load may be found by multiplying the weight of the product in pounds (W) by the specific heat (SpH), by the temperature differential (T D), the latter being the difference between initial and desired temperatures.

The formula for product load is therefore:

$$W \times SpH \times T\,D$$

Table V is also used for determining recommended temperatures for various products and care should be taken to select the proper temperature.

IMPROVEMENTS IN HOUSEHOLD REFRIGERATORS DURING PAST 5 YEARS

A TALK delivered at French Lick, Ind., June 10th, by Mr. E. B. Newill, assistant general manager of Frigidaire, to the American Society of Refrigerating Engineers' convention, outlined extensively the improvements in design and construction made in household refrigerators during the past four or five years. Listing the improvements enumerated and enlarged upon by Mr. Newill, they are as follows:

1. Better food protection.
2. Greater convenience in storage arrangements.
3. Reduced original and operating cost.
4. Greater dependability.
5. Quieter operation.
6. Improved compressor efficiency.
7. Lower temperatures.
8. Greater ice cube capacity and faster freezing.
9. Better insulation and cabinet construction.
10. Evaporators of a higher efficiency.

Tests on four different makes of refrigerators, making comparisons between 1938

COMPARATIVE TESTS

	RESULTS IN B.T.U. PER WATT HOUR	
MAKE	1938 UNIT	1937 UNIT
A	2.50	4.05
B	2.64	3.64
C	1.92	3.74
D	2.23	3.96

and 1937 models, revealed the following results in improved unit efficiency. The test was conducted in a 90 degree F. room, with a 7 degree F. refrigerant.

Though we are obtaining a lower cabinet temperature, we are also doing it with less current consumption. This is evident by a test made on 6 cubic foot models of three different makes, comparing between 1933 and 1937 models. The tests were made in a 90 degree F. room, using factory normal cold control setting and average ice and food loads.

The following table shows the results:

TEMPERATURE VS. ELECTRICAL INPUT

MAKE	YEARLY MODEL	CABINET TEMP.	KW-H PER DAY
A	1933	45.8	2.75
A	1937	42	1.66
B	1933	45	2.41
B	1937	41.3	1.62
C	1933	45.1	2.16
C	1937	41.3	1.66

Tests on an 8 cubic foot refrigerator under full load in a 90 degree F. room show the 1937 refrigerator capable of producing between 70 and 80 lbs. of ice in 16 hours.

A survey of insulating materials shows a decreased heat leakage factor in those materials used today as compared to five years ago. This fact, coupled with the improved cabinet designs using less wood in the construction and improved breaker strip and door designs, make it possible to hold lower cabinet temperatures in the 1937 models.

Improved design and construction in evaporators, giving more scrubbing or spraying action on the prime surfaces, have greatly improved the efficiency of the evaporator. This is proved by the fact that 1937 refrigerators are operating at a 4 degree F. lower cabinet temperature, but with a 6 degree F. higher evaporator temperature. This gives an increase of 23 per cent efficiency in the refrigerating machine.

Other mechanical improvements pointed out by Mr. Newill were: placing of high side floats at the top of the cabinet instead of the bottom to reduce refrigerating loss in long runs of tubing, improved lubrication systems, reduced bearing surfaces, thus reducing friction losses, and the high quality of machined parts.

Beauty of exterior and interior, wider and shallower cabinets putting shelf space nearer front, food racks on door, built-in thermometers, aluminum shelves, automatic ice tray release and mechanical release of cubes, add to the convenience to the housewife, while forced circulation of air and systems giving increased humidity have improved food preserving ability of the box.

8th Article, R. I. Field Motor Service Methods

Electronics for Servicemen

Making Repairs in Field on Repulsion-Induction Motors

By WALTER G. CHRISTIE, B.S.E.E.

MANY repulsion-induction motors can be successfully repaired in the field if the serviceman understands how these motors work so that he can diagnose the trouble.

The following procedure for testing and repairing motors in the field has been worked out by the writer after two years of experience as an electrical trouble shooter for a large refrigerator and air conditioning manufacturer in New York City who uses all types and makes of motors.

The hardest thing to acquire in diagnosing motor trouble in the field is the ability to quickly tell whether or not a motor must be returned to the shop for repair. In perhaps 75 per cent of the cases, the motor can be repaired on the job and the other 25 per cent of the time it should be returned to the shop.

In many cases the trouble can be diagnosed with about a two minute test. Once in awhile a motor will be completely disassembled before the real trouble will be found.

Test for Bad Bearings

First find out why the customer called for service. If the complaint is a noisy

machine or machine won't run, check for a bad bearing. To do this, pull the electrical plug out of the wall and slip off the belt. Then grab the pulley with both hands and try to move the pulley up and down and sideways. If any play is felt, the bearing is worn and the motor should be returned to the shop for a complete overhauling. Sometimes a motor with a slightly worn bearing can be made to work for several months by filling the oil wells with oil, but in the majority of cases, the motor should be replaced.

Test for Shorted Field

If the bearing tests all right, but the motor won't start its load, although it will start and run freely with a growling noise when the belt is removed just as if it had a bad bearing, replace the motor because one of the fields in the motor has become open circuited.

Test for Bad Necklace

Sometimes the complaint will be, "the motor makes three or four tries each time the refrigerator starts." This may be due to a number of different causes. The most likely is a bad necklace or short circuiting device. To check for a bad necklace, start the machine several times. Meanwhile, keep your eye on the motor commutator near the shaft. If you notice a sparking inside the commutator as the motor brushes try to leave the commutator, the necklace is bad and must be replaced.

This job can be successfully done in the field if the serviceman is careful to thoroughly clean the inside of the commutator slot and scrape the inside edge of the commutator with a knife or with a three cornered scraper made by grinding down the edges of a three-cornered file.

The necklace can readily be replaced on Century, Wagner, and Delco motors (other than Delco models 5199, 5150, and 5155) while the motors are installed in place on the refrigerator. Where the motor is equipped with a four-point suspended resilient mounting such as some of the Kelvinator models, the mounting interferes with the removal of the motor end bell and so the motor must be removed from the cabinet in order to change the necklace. The Delco models 5199, 5150 and 5155 are equipped with a driven-on motor spring retainer and unless a Delco retainer puller is available, these motors will have to be completely disassembled so that the retainer can be driven off the shaft with a hammer and a screwdriver.

In order to replace the necklace, remove the four through bolts which hold the end bells to the motor frame. Then hold the end bell in your left hand and pull on it while you lightly tap the motor frame with a hammer. The end bell will come off easily.

Next remove the oil thrower and the end play shims. Now remove the motor spring retainer. On Delco and Wagner motors, this is done by pressing in the retainer cup washer with a screwdriver and then removing the horseshoe washer which fits into a slot in the shaft and is held in place by the retainer cup washer. Take care to cover the end of the motor shaft with your hand before taking the screwdriver away from the cup washer or else the insides of the motor will fly outward and may injure you or become lost.

Now remove the brush holder and then fish out the necklace collar which is still inside the commutator slot. When the necklace collar is removed, the necklace which is wrapped around it will drop off.

Century motors are built slightly different than Delco or Wagner motors. These motors have the brush holder fastened to the motor end bell. Thus when the end bell is removed, the brush holder is automatically removed.

Removing Necklace

To remove the necklace, take a small screwdriver and pry out the thin sheet metal lock which locks the motor spring retainer nut to the motor shaft. Then unscrew the spring retainer nut and carefully count the number of turns until the nut drops off the shaft. *Mark down the number of turns so that when the motor is reassembled, the retainer nut can be screwed down the correct number of turns and the motor spring will be under the correct amount of tension.* Then remove the motor spring and pull out the necklace collar.

One of the primary causes of a bad necklace is oil. The oil forms an insulating coat on the necklace and on the inside face of the commutator. Then when the necklace short-circuits the commutator, the insulating coat of oil forms a resistance and as the heavy armature current flows through this resistance the necklace gets very hot and often burns through.

Therefore, the first operation to perform in replacing a necklace is to thoroughly

clean out the commutator slot with a rag wrapped around a screwdriver. After all traces of oil and dirt have been removed from the shaft and the commutator slot, carefully scrape the inside of the commutator with a knife until it is smooth and clean. Again carefully wipe out the commutator slot with a rag and then clean off all the motor parts.

The necklace on Century and Wagner motors are made of heavy bars of copper held together on a piece of steel wire. Because of their heavy construction, these necklaces seldom have to be replaced. Shine them up either with a knife or with a piece of sandpaper and then wipe all traces of oil and dirt from them.

On the other hand, necklaces used in Delco motors are made of formed copper wire and when necklace trouble develops, the necklace generally burns out and must be replaced. These necklaces cost about twenty cents wholesale so it is cheaper to replace them than to attempt to clean them up.

On Delco motors before model 4300 (that is on such models as 3140, 3480, 3145, 3147, etc.) the motor brush holders were made entirely of aluminum. As a result, the shoulder against which the motor spring retainer cup presses often wears out and throws groundup aluminum onto the necklace and causes necklace trouble. Therefore, before reassembling a Delco motor, examine the brush holder to see whether or not it is made entirely of aluminum. If it is, there is a good chance that the brush holder shoulder is worn very thin and may give way entirely in a short time. If this condition is found, replace the brush holder with one of the new style replacements which has a steel shoulder pressed into the aluminum brush holder.

When all parts have been cleaned, reassemble the armature and replace the motor end bell and the job is complete.

Worn Out Brush Holders

Sometimes on Delco motors the complaint will be "machine won't start." To test a job in this condition, turn on the switch and jam the brush holder up against the commutator. If the motor starts and continues to run after the brush holder is released, the brush holder shoulder (as explained in the foregoing paragraph) is worn out and should be replaced. When replacing a bad brush holder, it is a good policy to replace the necklace in the fashion already described.

Motor Pins Too Long

Sometimes a repulsion-induction motor will refuse to start because the bumpers against which the centrifugal weights hit when they fly outward become worn and let the weights push the necklace collar too far forward. When this happens, the curve in the necklace hooks over the edge of the commutator and when the motor stops, the necklace collar cannot return to its place inside the armature. Then the next time the motor tries to start, the armature will be short-circuited and the motor will just hum.

To repair a motor in this condition, disassemble the armature and file about 1/32" off each motor pin. Be careful that the two pins are the same length before you reassemble the motor. Before replacing the armature in the motor frame, take the two weights in your hands and pull them apart. When the weights are all the way apart, the necklace should not be more than flush with face of the commutator. If the necklace protrudes above the face of the commutator, disassemble the armature and file a little more off the rods until the necklace is just flush with or slightly under the face of the commutator.

Shorted Armature

At other times a repulsion-induction motor will refuse to start and pressing the brush holder against the commutator will not make it start. In a case of this kind, turn off the switch, slip off the belt and see that the motor is free to turn. Then turn on the switch and try to turn the armature by twisting the fan blades. If the armature was free to turn with the power off and refuses to turn with the power on, the armature is short-circuited.

Ninety percent of the time, the short circuit in the armature is caused by a broken necklace, a piece of which has wedged itself between the brush holder and the armature, thus short-circuiting the armature.

In order to check a short-circuited armature, remove the motor from the refrigerator and disassemble it. If a broken necklace is found, replace the necklace using the method given previously.

However, if the necklace is apparently all right, the short circuit must be in the armature itself. Very often this short circuit can be located and successfully repaired in the field. To locate the short circuit, take the

motor field and place the *disassembled* armature in the field. Then apply 110 volts to the field and try to turn the armature. If the armature is short-circuited, there will be a place where the armature can be turned with great difficulty. Hold the armature in this position against the opposing force from the field. Then with the armature in this position, examine the inside of the commutator where it is insulated from the steel of the armature itself. No doubt you'll see a small arc somewhere along the inside of the commutator. Mark this spot and turn off the power. The commutator is grounded at this spot.

Take a sharp knife and pick away at the burned insulation until all the burned part is removed. Then retest the motor for a short-circuited armature. As soon as the ground is cleared, flow some shellac into the resulting hole and allow it to dry. Then retest the armature and reassemble the motor.

Burned Out Motors

When no ground can be seen at the commutator or when the ground can't be cleaned up, the motor will have to be returned to the shop to be rewound.

Oftentimes when a motor has run for a long period with a bad bearing or with a bad necklace, the armature will get so hot that all the solder will melt and be thrown out of the commutator segments where the armature turns are fastened to the commutator.

Most of the time a motor in this condition may be made to work but it is good policy to return the motor to the shop for a resoldering job.

The serviceman must be careful in giving a repair price on a motor which has thrown its solder, for sometimes the armature needs rewinding and not just resoldering. To be on the safe side, it is good policy to disassemble a motor in this condition before giving a repair price.

Just remove the armature from the fields and press the wires with your fingers. If they seem solid, take a screwdriver and poke the fibre wedges which hold the wires into the armature slots. If these do not break under the pressure from the screw driver, the armature is no doubt o. k. However, if the wires move under the touch of your fingers and the wedges break under the pressure from the screwdriver, quote the customer the price for a rewinding job.

Absorption Refrigeration

Covering the Icy Ball, Electrolux and Simple Absorption Systems

By GEORGE H. CLARK,* B.S.M.E.

ABSORPTION refrigeration has been used in commercial work in the past and is used in a few types of household refrigerators at the present time. Absorption refrigerators make use of heat as the energy supply rather than mechanical or electrical energy as the prime mover so that absorption refrigerating machines can be operated where electric power is not available. For that reason absorption systems are particularly well adapted to rural districts that do not have electric power.

There are a number of different types of absorption refrigerating systems. All of them use the same principle. The principle of operation of any absorption system is that a refrigerant may be absorbed by some absorbent while the temperature of the absorbent is at room temperatures or slightly higher while the refrigerant is driven from the absorbent at high temperatures so that an absorbent can be made to discharge and absorb refrigerant.

The process of absorption is usually accompanied by the liberation of heat. When the absorbent is holding all the refrigerant which it can or which we decide is the practical amount for it to hold for our particular system, we heat the absorbent and by the addition of heat and raising the temperature we cause the absorbent to give up the refrigerant at high pressures and temperatures.

When the refrigerant is separated from the absorbent, it can be condensed in any

* Detroit School of Refrigeration. Chairman, National Educational and Examining Board, R.S.E.S.

kind of air or water-cooled condenser from which it may pass to a liquid receiver and the liquid refrigerant may then be passed through an expansion device into the evaporator where it evaporates and passes back into an absorbent at low temperature.

At the low temperature, the absorbing power of the absorbent is so great that it will hold a large amount of the refrigerant and will pick it up at comparatively low pressures which will cause the refrigerant to evaporate at low pressures in the evaporator.

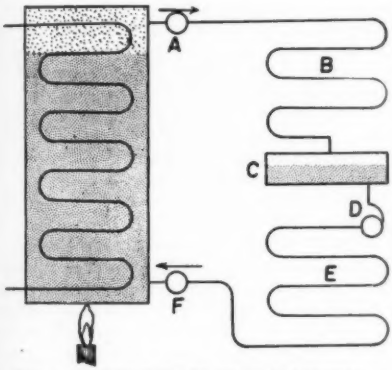

FIG. 1. SIMPLE TYPE OF ABSORPTION SYSTEM.

Fig. 1 shows a simple type of absorption system. It consists of a generator which contains water as absorbent. During the generating part of the cycle we use heat of some kind, possibly a gas flame, to heat the water which also contains a large amount of ammonia as a refrigerant. This strong solution of ammonia and water is generally referred to as the "strong liquor" and on being heated we drive a large part of the ammonia from the water. This ammonia vapor passes through the check valve *"A"* which will not allow it to return to the generator and passes through the condenser coil *"B"* which condenses the ammonia to a liquid which passes to the liquid receiver *"C"*. The liquid then feeds to the expansion valve *"D"* which controls the flow of refrigerant into the evaporator *"E"*.

While our heat is being used, the refrigerant will be driven out of the generator to the check valve, then condensed and stored in the liquid receiver. During this part of our cycle we do not produce any refrigeration, but, after we have driven all the ammonia out of the water that we think practical, we can shut off our heat supply and then pass water through the cooling coil in the generator. This water with the ammonia driven out is now termed "weak liquor." As this weak liquor is cooled by the water passing through the coil, the pressure in the generator which during this part of the cycle becomes an absorber is reduced to a pressure lower than that which the expansion valve is set to maintain with the result that the refrigerant feeds through the expansion valve evaporating in the coil *"E"* and passing through the check valve *"F"* into the weak liquor where it is reabsorbed and during this part of our cycle we produce refrigeration.

This cycle of refrigeration is intermittent and we could compare this type of refrigeration to the conditions we would obtain if we had a large cylinder and piston in operation as pictured in Fig. 2. As the piston moves up to the top of the cylinder, the gas would be compressed and forced out through the check valve *"A,"* passed through the condenser *"B,"* and to the liquid receiver *"C,"* so that the refrigerant vapor which was contained in the cylinder is compressed and condensed into a liquid and stored in the liquid receiver. When the

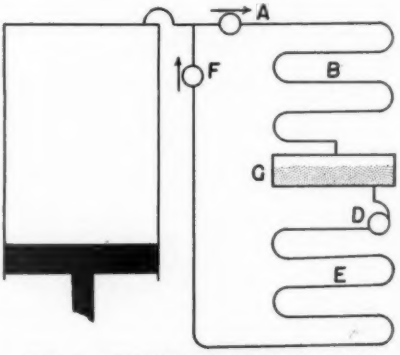

FIG. 2. COMPARATIVE PISTON TYPE.

piston has reached the end of its stroke, we cause it to start moving down again which will cause the pressure above the piston to be reduced to a point below that at which the expansion valve opens. The expansion valve *"D"* opens feeding refrigerant through the evaporator *"E"* and the check valve *"F"* into the cylinder.

The absorption system, then, compares with a compression system where we might

use an extremely large cylinder and piston but where the rate of movement of this piston is extremely slow.

The time required in driving the ammonia from the strong liquor may be from 15 minutes to one hour which would correspond to the time required in moving a single piston up a cylinder in a corresponding compression system. Then, while we are producing refrigeration, the pressure in the cylinder is reduced to the pressure for which the expansion valve is set and refrigeration may be produced from one-half to three hours time or possibly more which would mean that in a corresponding compression system our piston would be moved down the cylinder for a period of from one-half hour to three hours.

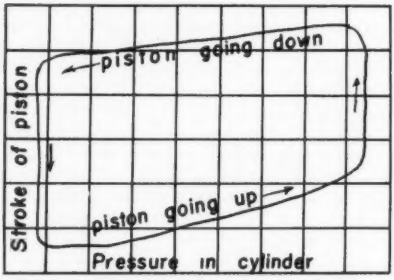

FIG. 3. CYLINDER PRESSURE CURVE.

Fig. 3 shows an approximate curve of the pressures that would be obtained in the cylinder of the piston type machine or in the generator of the absorption type machine while the system is in operation. The figure shows that as the heat is applied to the strong liquor the pressure goes up fairly rapidly to the pressure at which the refrigerant vapor is condensed in the condenser; and, then, as our heating cycle is stopped and we cool our weak liquor, the pressure in the absorber is soon reduced to the pressure at which the expansion valve is set to open when refrigeration takes place. We show the condensing pressure and the evaporating pressure on the same curve.

This corresponds to the condensing pressure and suction pressure when using the same refrigerant in any other type of refrigerating system.

Since this type of system is inherently an intermittent system, it may not produce the desired conditions and we can improve on this by using two or more generators. Fig. 4 shows a system containing two generators which are connected through check valves to one condenser coil and liquid receiver. The liquid from the receiver then passes to the expansion valve which feeds the refrigerant into the evaporator from which it feeds to either one of the two generators through the respective check valves.

At one part of our cycle we have heat applied to the left generator while water passes through the cooling coil in the right generator which due to its low temperature acts as an absorber so that during this part of the cycle the ammonia vapor would be driven out of the strong liquor in the left generator and pass through the check valve into the condenser where it condenses and passes into the liquid receiver, then to the expansion valve and evaporates in the evaporator and is absorbed in the right hand side which is kept cool by the circulation of water through the cooling coil.

When the left-hand cylinder has given up most of its ammonia and the right-hand cylinder has absorbed about all it can practi-

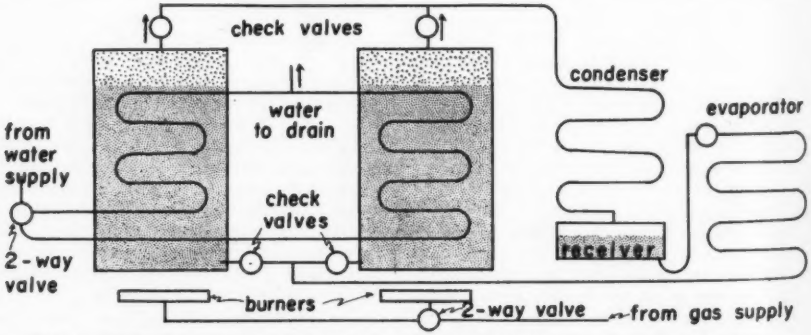

FIG. 4. SIMPLE TYPE OF ABSORPTION SYSTEM EMPLOYING TWO GENERATORS.

cally hold, we reverse our cycle by a system of valves so that we turn on our gas flame under the right-hand cylinder and close off our water to the right-hand cylinder while we stop our gas flame under the left-hand cylinder and turn on our water to the cooling coil. This will cause the pressure in the left cylinder to be reduced so that it will absorb refrigerant from the evaporator while the pressure in the right cylinder will be increased so that it will force refrigerant into the condenser where it is condensed and fed into the liquid receiver.

This system is essentially the same as a two-cylinder compression system would be where the cylinders are quite large but move very slowly. This can be extended to three cylinders or more as desired.

Another type absorption system that has been used considerably is known as the Icy-ball refrigerator. This consists of two iron balls connected together by means of a pipe. During the generating part of the cycle the larger of the two balls is heated by means of some sort of heating stove and the ammonia is driven off into the smaller of the two balls. As the heat is removed from the smaller of the two balls, the ammonia vapor condenses into liquid form.

Refrigerates 20 Hours Per Day

During this heating or generating cycle the refrigerator does not get any refrigeration and, in fact, these working parts of the refrigerating system are kept out of the refrigerator during this period. When the larger of the two balls has been heated sufficiently, usually over a period of from one to two hours, a sufficient amount of ammonia vapor will be condensed in the smaller of the two balls. Then the smaller of the balls is located on the inside of the refrigerator while the larger one is suspended on the outside of the refrigerator. As the air circulates by the larger of these balls it cools the water which is contained in the ball so that it has a high absorbing power for the ammonia vapor with the result that the pressure is lowered and the refrigerant evaporates in the smaller ball producing refrigeration while it is absorbed in the larger or outside ball.

This type of system is usually furnished with a kerosene stove which may be used for heating, or it may be heated by means of the cookstove while preparing the meals on the farm. The absorption or refrigerating period is intended to last for the larger part of the day; that is, from 20 to 22 hours and, of course, the evaporator will have variable temperatures during this time. Probably, the temperature in the refrigerator will have reached a minimum after a few hours of the refrigerating part of the cycle and it will then gradually rise during the remainder of the day. However, the temperatures are usually kept within safe limits for food preservation at all times.

Ammonia Most Adaptable

Ammonia is a particularly good refrigerant for use in absorption refrigeration because it has a high latent heat in that it will pick up some three to four times as much heat for each pound of ammonia evaporated as can be picked up by evaporating a pound of methyl chloride. One pound of ammonia in evaporating, then, will be as effective as from 8 to 12 pounds of "Freon." Although the ammonia has a comparatively low specific gravity in the liquid state as compared with the other refrigerants, the volume required to produce a given amount of refrigeration is much less than any of the other common refrigerants.

Ammonia also works especially well for absorption systems in that water makes a very good absorbent and water, of course, is both cheap and readily obtained and the fact that it is a liquid is of some benefit in an absorption system as well.

Using Silica Gel

Similar absorption systems have been made using solid absorbers. One of the common solid absorbers is silica gel. Silica gel has a high absorbent power for water vapor and also for sulphur dioxide so that it may be used as an absorbent when using sulphur dioxide as a refrigerant. Silica gel will absorb in the neighborhood of 25 to 35 per cent of its own weight of sulphur dioxide, so that if we were to use 10 pounds of silica gel in a small system, we could expect to absorb from two and one-half to three and one-half pounds of sulphur dioxide which would produce the equivalent of approximately two and one-half to three and one-half pounds ice melting equivalent. If we were to use an ammonia absorption system and we were to evaporate two and one-half to three and one-half pounds of ammonia, we could produce the equivalent of approximately 10 pounds ice melting equivalent.

In the Icy-ball refrigerator 7 pounds of water and 5 pounds of ammonia are used for the Icy-ball used in conjunction with a small refrigerator.

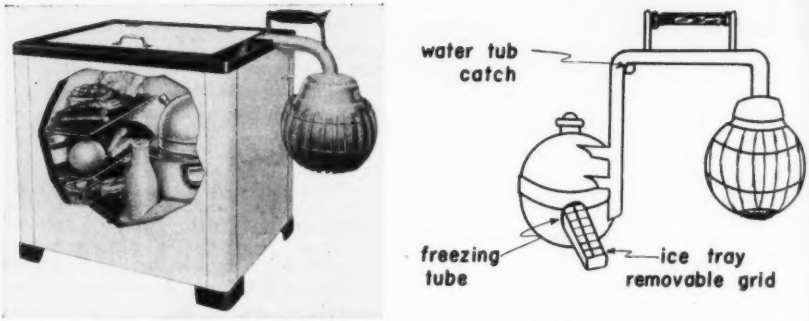

FIG. 5. ARRANGEMENT AND DIAGRAM OF THE CROSLEY ICY-BALL.

Fig. 5 shows the general arrangement of the Icy-ball refrigerator.

Another absorption system which is used with considerable success in rural districts where electric energy is not obtainable is known as the Trukold refrigerator sold by Montgomery Ward & Company and manufactured by the Gibson Company. Figs. 6a and 6b show the construction details of the Gibson refrigerator.

Figs. 7a and 7b show the operation of the Superfex absorption system in which the ammonia is driven from the generator *"A"* to the condenser coil located in the tank of water on top of the refrigerator where it is condensed and carried into the evaporator as a liquid. Fig. 8b shows the refrigerating part of the cycle with the refrigerant evaporating in the evaporator and being absorbed by the water in *"A"* which with the heat discontinued becomes the absorber.

A special feature of this absorption system is the freezing liquid contained in the lower part of the evaporator. The freezing liquid never entirely melts during the generating part of the cycle and freezes during the refrigerating part of the cycle so that the temperature of the compartment *"J"* remains practically constant throughout the whole 24 hours.

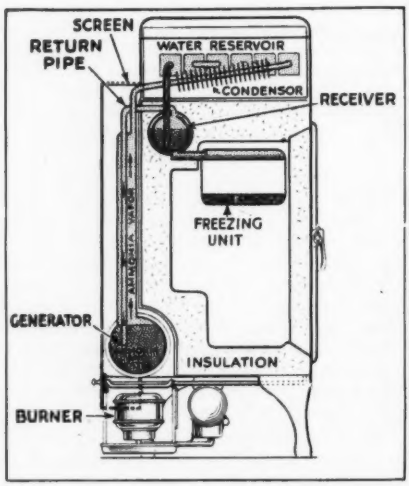

FIG. 6A. CROSS-SECTION GIBSON ABSORPTION UNIT.

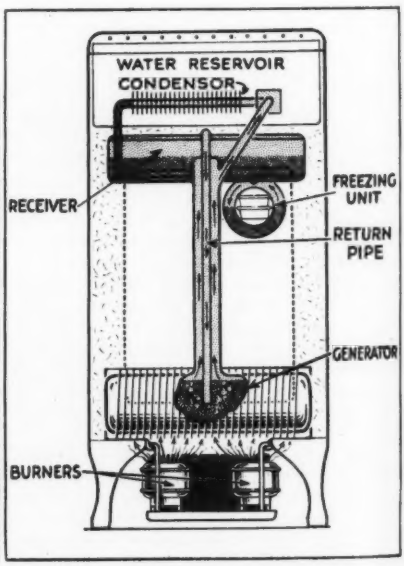

FIG. 6B. CROSS-SECTION GIBSON ABSORPTION UNIT—REAR VIEW.

FIG. 7a. CROSS-SECTION OF SUPERFEX UNIT WHILE HEATING. REFRIGERATING

FIG. 7b. CROSS-SECTION OF SUPERFEX UNIT WHILE COOLING. REFRIGERATING

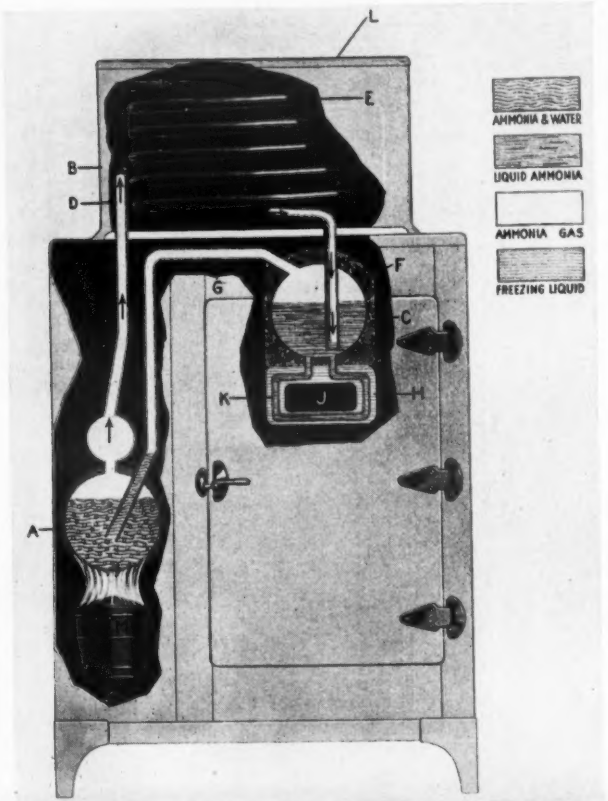

FIG. 7a. CROSS-SECTION OF SUPERFEX REFRIGERATING UNIT WHILE HEATING.

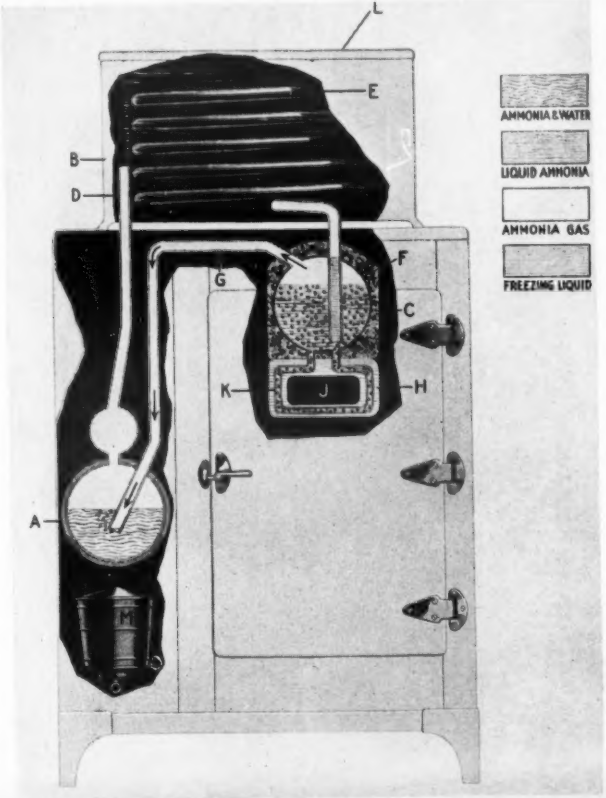

FIG. 7b. CROSS-SECTION OF SUPERFEX REFRIGERATING UNIT WHILE COOLING.

The burner is filled with kerosene once a day and, when the kerosene has burned out, sufficient time will have elapsed so that the ammonia is all driven through the condenser and condensed and during the rest of the day the system operates on the refrigerating part of the cycle.

Any absorption system using ammonia necessarily cannot use any copper or any of its alloys in its construction and most of the absorption systems are made entirely from steel or iron.

Eutectic Solution Used

One of the particular features of this refrigerator is that the evaporator makes use of a freezing solution which becomes frozen during the refrigerating part of the cycle and which has a sufficient hold-over in this frozen solution so that the solution does not entirely melt during the generating part of the cycle so that the cooler in the refrigerator cabinet is maintained at constant temperatures during the whole 24 hours whether the system is generating or absorbing.

One thing to keep in mind with an absorption system using ammonia as a refrigerant and water as an absorbent is that in order to have the water pick up the ammonia readily during the absorption process one must be sure that the ammonia bubbles through the water so that it is readily absorbed. If the ammonia vapor enters the top of the absorber and only contacts the surface of the water, the rate at which it will be absorbed is greatly reduced. In the Icy-ball refrigerator a special liquid trap is used to cause the ammonia vapor to bubble through the water.

In the Montgomery Ward absorption system it will be noted that a liquid trap is also used so that during the generating part of the cycle the vapor passes through the condenser coil rather than liquid forced up through a difference in level which would require a difference in pressure between generator and evaporator. In the absorption part of the cycle the ammonia returns from the evaporator as a gas rather than the liquid ammonia being drawn up through a tube which would require a pressure difference between the evaporator and absorber.

The absorption system which is sold more than any other in cities where either artificial or natural gas is available as a source of energy supply is a continuous process refrigeration system known as the Electrolux. This system makes use of the fact that the temperature at which a refrigerant boils depends on its vapor pressure. If we have a liquid in a container although the pressure in the container may be quite high, if there are other gases in the container, the vapor pressure of the particular liquid may be low enough so that the liquid may boil at a comparatively low temperature.

Fig. 8 shows the lay-out of the Electrolux system. The gas flame heats the weak liquor and then passes on to heat the strong liquor which causes the liquor and ammonia bubbles to pass up into the device labeled the weak liquor stand-pipe. The pump tube acts the same as the tube in a coffee percolator to send up drops of liquid inbetween bubbles of steam. As the liquid and the vapor pass out the upper part of the pump tube, the water separates from the ammonia and the water then being weak in ammonia is shown as weak liquor. The ammonia passing out of the top of the weak liquor stand-pipe passes through the device labeled the submerged analyzer. This hot gas in passing through the submerger analyzer may cause more ammonia vapor to be separated from the strong liquor and the combined ammonia vapor passes to the finned tube indicated as the high temperature rectifier and then on into the device indicated as being the rectifier. It then passes through the primary ammonia condenser where part of the ammonia is condensed into a liquid. The liquid which condenses passes over into the evaporator while the vapor which has not condensed passes into the secondary ammonia condenser where after being condensed it passes through a liquid trap to the upper part of the evaporator.

Work of Inert Gas

The hydrogen from the gas heat exchanger also passes into the evaporator to exert a pressure on the ammonia. The total pressure in the evaporator is the same as in the other parts of the system, but, due to the fact that part of the pressure is made up of hydrogen, the actual ammonia vapor pressure is much lower than in other parts of the system with the result that the ammonia boils at a low temperature. The ammonia vapor and hydrogen mixture then pass into the central tube of the gas heat exchanger and, since the density of the mixture of hydrogen and ammonia is greater than the density of pure hydrogen, this heavier gas mixture passes down through the gas heat exchanger into the absorber. It then passes upward by the series of baffle plates over

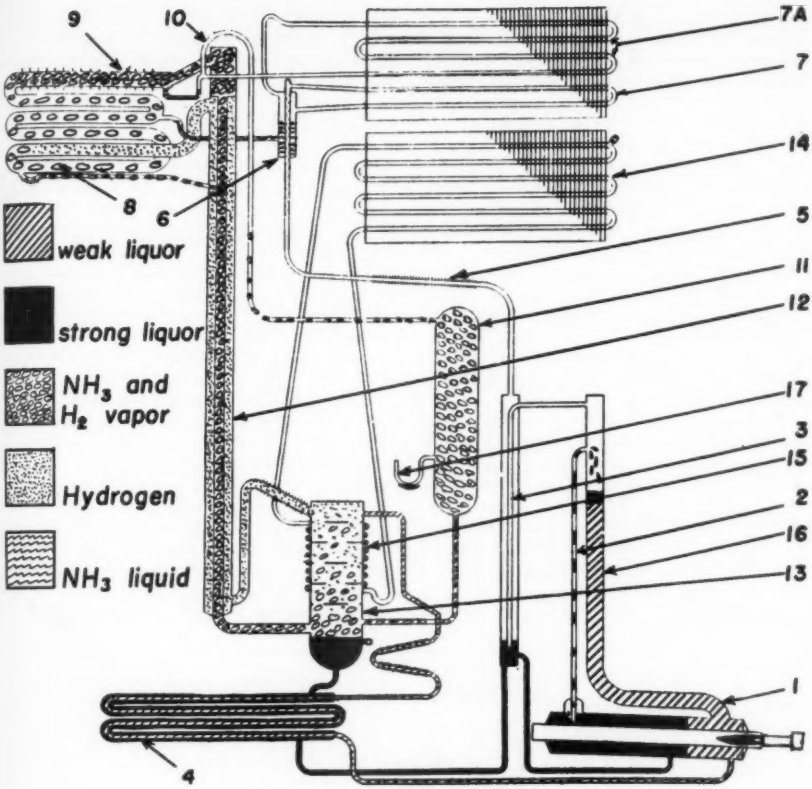

FIG. 8. THE ELECTROLUX CYCLE.

1. Generator
2. Pump Tube
3. Submerged Analyzer
4. Liquid Heat Exchanger
5. High Temperature Rectifier
6. Rectifier
7. Ammonia Condenser, Lower Part
7a. Ammonia Condenser, Upper Part
8. Freezing Evaporator Coil
9. Box Cooling Evaporator Coil
10. Equalizer
11. Pressure Chamber
12. Gas Heat Exchanger
13. Absorber
14. Methyl Chloride Condenser
15. Absorber Coil
16. Weak Liquid Stand Pipe
17. Fuse Plug

which the cool water is caused to drip at the same time that the whole absorber is kept cool. As the water drips down over the plates and the mixture of ammonia and hydrogen vapor passes up by the plates the ammonia is absorbed by the water leaving the free hydrogen to pass on up into the gas heat exchanger. The water which has picked up the ammonia is now a strong liquor and passes down to the heat exchanger shown as a double tube affair similar to a counter-flow water-cooled condenser in which the strong liquor in passing through the outer tube absorbs heat from the weak liquor passing through the inner tube which produces the cooling effect on the weak liquor which we want before it gets to the absorber at the same time it gives heat to the strong liquor so that it will not require as much additional heat in the generator itself.

In tracing the path of the water we find that it passes from the weak liquor standpipe down through the liquid heat exchanger into the absorber where it becomes a strong liquor, coming back through the liquid heat exchanger and giving up a small amount of ammonia in the submerged analyzer and then passing back to the strong liquor side of the liquid heat exchanger. This system

in comparison to the compression system is considerably more complicated, but has the advantage that there are no moving parts to consider and that the system is practically noiseless; but it has the disadvantage that there is always a certain amount of the burned gas being passed into the room in some cases carrying a certain amount of grease or dirt along with the gases.

The cost of operation may depend on the relative cost of gas and electric energy in whatever locality the machine is used. This refrigerating system makes use, then, of water as an absorbent, ammonia as the refrigerant, hydrogen as a catalytic agent—in other words, a gas introduced into the system simply to exert a pressure—and it also makes use of methyl chloride in cooling the absorber.

A coil located around the absorber is kept almost full of liquid methyl chloride and this picks up heat, as it evaporates, from the absorber. The methyl chloride in the vapor state then passes to the methyl chloride condenser where it condenses and runs by gravity down to the bottom part of the coil around the absorber where it again picks up heat from the absorber.

There is also a pressure chamber used in conjunction with this type of system which acts as a storage chamber for a mixture of hydrogen and ammonia vapor. There is also a fuse plug located in this chamber which will open up if excessively high temperatures are reached in this part of the system.

The Faraday absorption refrigeration system is a product of the General Motors Corporation and consists of the same general principle as the Gibson refrigerator except that it makes use of a horizontal absorber and condenser.

The condenser in the Faraday system is water cooled by means of water from some available supply line with the outlet water going to a drain.

The horizontal construction of this system and the mechanical construction allows a very rapid absorption of ammonia during the refrigerating part of the cycle and the very rapid separation of ammonia from the water during the generating part of the cycle. The generator is surrounded by steam to provide uniform heating during the generating part of the cycle while the generator is surrounded by water during the absorption part of the cycle which tends to produce more rapid and uniform cooling of the absorber during the refrigerating period.

Fourth Article

Air Conditioning

Humidifiers and Damper Controls

By W. C. FARMINGDALE

THE individual room conditioner uses one of several methods of humidifying (adding moisture to) room air in the heating season. The type of humidifying equipment that is used, often depends upon the installation conditions that can be used in that particular room. If a gravity drain or a suction pump can be installed to rid the conditioner of waste water, a spray type of humidifier can be used.

The spray type humidifier seems to be the best type from a simplicity and an automatic operation viewpoint. The spray humidifier assembly consists of a solenoid valve operated by a switch on the top of the cabinet, a pressure regulating valve, a strainer, and a spray head, all connected as shown in Fig. 1.

When the humidity switch is closed, the water solenoid valve opens and allows water to flow into the spray head. The spray head consists of a fine jet through which the water passes in a fine stream. Above the jet is located a striker plate. When the fine stream of water hits the striker plate it is broken up into very fine drops. The spray head is located in a copper container through which the conditioned air must pass before being discharged into the room. The spray chamber is generally located behind the heating coil so that the conditioned air is heated before being passed through

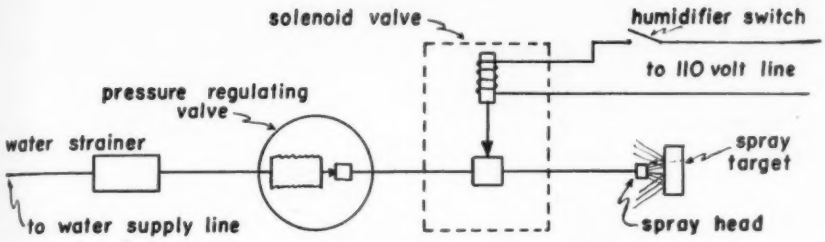

FIG. 1. TYPICAL HOOK-UP OF SPRAY TYPE HUMIDIFIER.
When humidifier switch is closed, water flows through the spray-head and strikes the target, where it is broken up into a fine mist.

the spray mist. Because the air has been heated, its relative humidity has been greatly *decreased* and its ability to absorb moisture has been increased manifold (see article two in April REFRIGERATION SERVICE ENGINEER). Thus the conditioned air absorbs a relatively large amount of the spray mist which results from the jet of water striking the striker plate and the air in the room becomes humidified.

The efficiency of a spray type humidifier depends upon the pressure at which the spray head is used. If too low a pressure is used, only a small amount of the water will be broken up and little humidifying will result. On the other hand, if the spray is operated at too high a pressure, more water will be broken up than can be absorbed by the conditioned air passing through the conditioner and the customer's water bill will go up and if a suction pump is used to remove the waste water, the power bill will also go up. To eliminate this condition of inefficiency, most manufacturers use a pressure regulating valve in the water line, which if the water line pressure is too high, automatically reduces the pressure to the desired range. To prevent inefficiency from low water pressure, the manufacturers specify the minimum pressure at which the humidifier should be operated. Hence, before the job is installed, the installation man should check the water pressure with a gauge. (At this time it might be well to emphasize the importance of marking and then keeping one pressure gauge for use on water circuits alone. If this is not done, the service or installation man is liable to use his water gauge to check refrigerant pressure and then trouble is sure to occur with the air conditioner because of water in the system.)

Drip Type Humidifier

A second type of humidifier consists of a pan which must be filled with water and a porous length of ¼ inch tubing which runs from the pan along the top of the heating coil as shown in Fig. 2. The water flows from the pan into the porous tube where it slowly drips along the guide wires onto the hot fins of the heating coil. When the water hits the hot fins it is quickly vaporized into the conditioned air stream and is carried upward by the fan as shown in Fig. 2. The only draw back to this method of obtaining humidity is that the pan has to be continuously filled. Where a gravity drain is available to look after the waste water which is not vaporized, a float switch in the water pan connected to a solenoid valve in a water supply line would make this method of obtaining humidification work automatically. The system could be laid out as shown in Fig. 3.

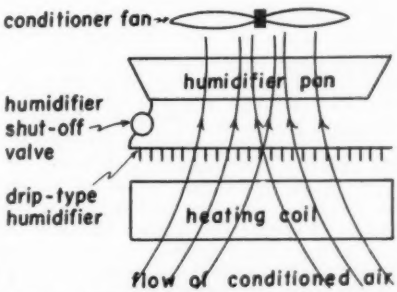

FIG. 2. TYPICAL HOOK-UP OF DRIP TYPE HUMIDIFIER.
Water flows out of humidifier pan into porous tube. Here it drips onto the hot heating coil, where the water is vaporized and is carried into the room by the air stream.

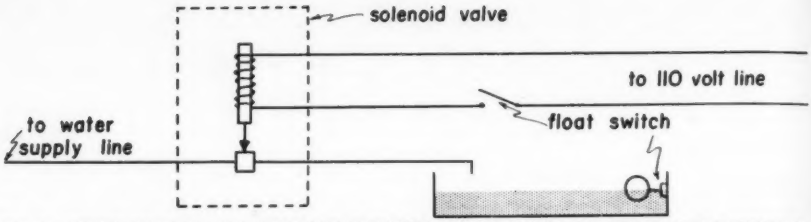

FIG. 3. HOOK-UP TO MAKE HUMIDIFIER SHOWN IN FIG. 2 RECEIVE ITS WATER DIRECTLY FROM THE WATER SUPPLY.

Portable Type Humidifier

A very popular type of humidifier consists of an electrically-driven centrifugal atomizer, to the shaft of which is attached a set of fan blades. Fig. 4 shows a conventional method of hooking up the equipment used in this type of humidifier.

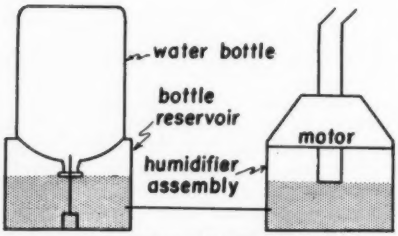

FIG. 4. DIAGRAM OF PORTABLE TYPE HUMIDIFIER.

The bottle supplies the water to the centrifugal atomizer and as long as any water is in the bottle, the proper water level is provided in the atomizer reservoir. The atomizer then picks up water from the reservoir and throws it against a series of baffles which breaks the water up into fine drops. Then the air from the built-in fan picks up these fine drops of water and carries them out into the room air. The discharge spout on the atomizer is generally placed so that the moisture laden air from the atomizer is thrown across the discharge grill of the conditioner. Then the heated air from the conditioner rapidly absorbs the moisture because the relative humidity of the heated air is very low (see article two April issue REFRIGERATION SERVICE ENGINEER) and carries it to all parts of the room.

The bottle on this humidifier must be filled manually. To prevent the humidifier from running when the bottle is empty, many manufacturers use a float switch installed in either the bottle or atomizer reservoir. The hookup for this safety control is shown in Fig. 5.

The bottle automatically keeps the water level from getting too high. This works as follows: When the bottle is inverted in its reservoir, the valve pin in the bottle rests on the valve strike (see Fig. 5) and water flows out into the reservoir. As the water leaves, a slight vacuum is created in the bottle which is broken by air entering the neck and showing up as large bubbles. When the water level in the reservoir reaches the neck of the bottle no more air can enter, and as the water flows out again, the vacuum inside the bottle cannot be broken. Water continues to flow into the reservoir until a balance is struck between the weight of water and the vacuum inside, and the atmospheric pressure outside the bottle. When this balance is struck, no more water can leave until the water level

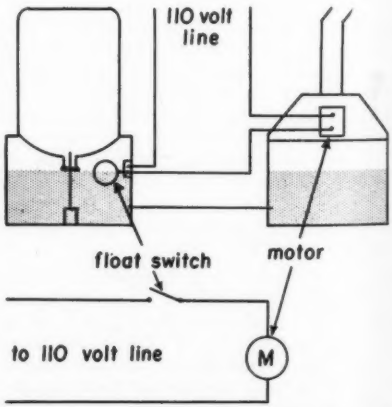

FIG. 5. HOOK-UP USING FLOAT SWITCH TO STOP THE ATOMIZER ON LOW WATER LEVEL.

in the reservoir falls below the neck of the bottle and then the cycle repeats itself. By this means the bottle automatically keeps the water level in the reservoir from becoming too high.

Damper Controls

Most room conditioners today supply fresh outdoor air to the room in order to keep the room air fresh and alive. Now it must be apparent that the amount of fresh air that is brought into the conditioned space will automatically increase the load on the conditioner in both winter and summer.

In winter if the outside temperature is about zero degrees and the fresh air damper on the conditioner is set wide open, so much cold air will be brought into the room that the heating coil in the conditioner will not be able to raise the temperature of this air to 70 degrees and as a result the room will be cold.

In summer, if the outside temperature is 95 degrees and the damper on the conditioner is left wide open, so much hot air will be drawn into the conditioner that the cooling coil will not be able to produce any noticeable cooling effect in the room. For this reason some form of damper control is necessary.

Some manufacturers have gotten around the open damper situation by providing such a limited fresh air duct that a maximum of from 60 to 80 cubic feet of air per minute can be taken into the conditioner. However, other manufacturers realize the draw backs in this limited supply of ventilation and have provided fresh air ducts and dampers which will allow the conditioner to bring in from 0 to 400 c.f.m. of fresh air. This is done because on many spring and summer days, sufficient cooling effect can be obtained by just circulating a large volume of air whereas if the unit supplies limited ventilation facilities, the refrigeration machine will have to be used in order to provide a comfortable atmosphere. Then too, smoke conditions or the number of people in a room might require more ventilation than 60 to 80 c.f.m. and on all but days of extreme outside temperatures the conditioner will be able to handle the greater load imposed on it by the larger amount of ventilation required.

Two types of automatic damper controls are provided—one the positive action type, the other the undulating type.

With the positive action type, the damper is either open or closed. The amount the damper will open can be set by adjusting the manual damper control. Thus the amount of fresh air admitted each minute depends upon how the customer sets the manual damper control.

The modulating damper control will vary the amount of air admitted from zero to a maximum. The amount the damper opens depends upon the temperature of the conditioned air passing through the unit.

The operation of the positive type damper control will be described first. This damper control is operated by a thermostat placed in the air stream inside the room conditioner. When the temperature of the air falls below a certain value (determined by test to suit each individual room) the thermostat causes the damper control to pull the damper closed. Then when the temperature of the air stream rises to a predetermined point, the damper control opens the damper as wide as the setting on the manual control will permit.

How a Common Type of Damper Control Operates

The most common type of damper control consists of a heat motor connected to a system of levers which open or close the damper.

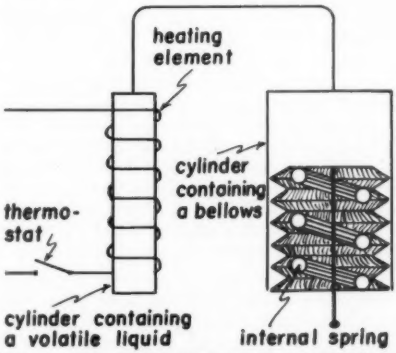

FIG. 6. DIAGRAM OF THE HEAT MOTOR. Rod which moves up and down to operate a system of levers to open and close the outside damper.

This mechanism is shown diagrammatically in Fig. 6. The heat motor consists of a small cylinder containing a volatile liquid, connected to a second cylinder in which there is a bellows. An electrical heating coil is wrapped around the first cylinder and is connected in series with the thermostat. When the thermostat closes, the heating coil gets hot and heats the first cylinder.

This causes the volatile liquid to turn into a gas and build up a pressure inside the first cylinder. This pressure is transmitted to the second cylinder by the connecting tube shown in Fig. 6. The increase in pressure in the second cylinder forces the bellows downward and the connecting rod on the bellows moves a system of levels which open the damper. Then when the thermostat opens the electrical circuit, the first cylinder cools off, the pressure on the gas is reduced and the spring inside the bellows (see Fig. 6) causes the bellows to close the damper.

In winter time this damper control will shut off outside air as soon as the room gets too cold due to failure of the heat supply, failure of electric power to the conditioner fans or because of too cold an outside temperature.

In summer time, this damper control will close the outside damper as soon as the room conditioner shuts off due to room being cool enough or failure of the electric supply to the conditioner. This prevents the inflow of warm outside air and thus helps to maintain a comfortable condition in the room.

The Question Box

Readers are invited to send their problems pertaining to the servicing of household refrigerators and small commercial refrigerating equipment as well as oil burners to "The Question Box." The following questions are answered by Mr. George H. Clark.

COOLING BEVERAGES

QUESTION 205. Please advise if a water bath for cooling beverages that contains enough floating ice to hold the water about 32 degrees F. will cool drinks quicker than a bath at about 32 degrees F. that contains no ice.

It stands to reason that the heat transfer would be no quicker if the bath temperature is the same in both cases, but you can melt the ice and still have about 32 degrees F. water and if the heat load is the same for a bath at about 32 degrees F. the temperature of the water will have to rise, whereas with the ice bath you probably would still have 32 degrees F. water.

As a refrigeration serviceman, I haven't yet seen a bottled beverage cooler that is a very good one from a refrigeration viewpoint. The water bath is always too small for the amount of drinks the customer sells. He sells them faster than they can cool. If the water bath were large enough, it would usually take up too much space. If the temperature of the bath is lowered below freezing, that is unsatisfactory and dangerous, because the bottles freeze to the bottom and sides and are usually broken in trying to get them loose.

Would it be an advantage to have the ice melted loose from the evaporating coils by raising the temperature of the coil just above the melting point on the off-cycle and then freeze more ice around the coil on the running cycle and keeping your bath filled with pieces of ice? Would the waste of refrigeration be impractical? I am aware that I would have to have a differently designed evaporating coil from the customary one to accomplish this.

ANSWER: In an ice and water bath the temperature of the water at the bottom, if there is any heat input to the bath and it is not agitated, will generally be about 40 degrees. If we had a tank of water at 32 degrees it would, of course, cool bottled drinks fully as quickly as a tank of water at the same temperature and containing ice, but the water would soon warm up to a higher temperature so that the drinks would then be in comparatively warm water. If we have ice in the water the ice melts absorbing the heat which has been picked up from the bottled drinks. There should be no waste in refrigeration resulting from raising the temperature of the coil just above the melting point of ice during the off period. But in general in order to keep ice in the tank the temperature of the coil never gets above 32 degrees so that the ice remains frozen on the coil. The ice does as much good, of course, when it is on the coil as it would as floating ice, in the tank. In general it is well to keep in mind that the so-called ice water is not at ice temperature. The temperature at

the surface of water and ice is always 32 degrees, but in an ice and water bath the temperature, as far as cooling drinks is concerned, is more generally about 40 degrees.

LEAKY SUBMERGED COIL

Question 206. When you have a submerged coil in a tank whether it be in a brine tank used for dairies, an ice cream cabinet, or the like and methyl chloride is being used as the refrigerant, is there a test to determine whether this coil is leaking refrigerant (methyl) into the tank solution, without going to the trouble of removing the tank coil?

Answer: In order to test a coil in a brine tank without removing the coil I believe as satisfactory a method as any is to seal up one end of the coil with a pressure gage, being sure there are no leaks around the gage and then install a valve at the other end of the coil. Pump a high air pressure into this coil and then close off the valve making sure there are no leaks at the valve and let the coil stand with the pressure on it for a matter of several hours. If there is no drop in pressure, indications are that the coil has no leaks. An effort should be made, in making a test of this kind, to remove any oil or liquids from the coil that might be in it. I would recommend that a pressure between 200 and 300 lbs. per square inch be used to make this test. If there is any oil in the coil there may be an initial drop in pressure of possibly 5 to 15 lbs. per square inch due to forcing some of the air into solution with the oil. If there is no continued drop in pressure there are no coil leaks.

MOTORS

Question 207. (1) What type of motor will run on either a.c. or d.c. current?

(2) How many wires must be connected with a two-phase motor? Can a single-phase motor be operated from a three-phase circuit?

(3) Can a d-c. motor run without commutator brushes and what is likely to happen if the motor frame is not grounded?

(4) How would you test a motor for finding the number of poles and what will happen when a single coil is short-circuited?

Answer: Any type of direct current motor will run on alternating current if the motor has laminated cores. Motors of this type are referred to as universal motors. They will usually develop somewhat more power on direct current than they will on alternating current. Vacuum cleaners, electric drills and small fans often use universal motors.

Four wires must be used for a two-phase motor.

A single-phase motor can be operated from two of the three wires of a three-phase circuit. We used to use 220 volt single-phase motors for loaner service by connecting two lines of the 220 volt three phase circuit.

Not having the frame of a d.c. motor grounded should not cause any difficulties outside of radio interference. Radio interference is taken care of by connecting electrical condensers from each brush to ground.

The number of poles in a motor can be determined by inspection of the windings and cores. These might be located also by a piece of steel or iron when the coils of the motor are connected to a power line. Each pole will have a strong attraction for a steel bar.

CLEANING COMPOUNDS

Question 208. In February, 1937, issue of the Refrigeration Service Engineer in answering question No. 182, you advise using Xyolene to clean the receiver of a Frigidaire that had been stuck-up due to moisture. Will Xyolene clean all the parts or only inaccessible places, such as the receiver mentioned? What is Xyolene and where can it be purchased? Is it better than tri-sodium phosphate mentioned in the January issue?

Answer: Xyolene is an excellent solvent for the binder of carbon sludge which forms in sulphur dioxide refrigerating systems as the result of moisture and sulphur dioxide breaking down the oil. It should do a fairly good job of cleaning, although I am doubtful of its ability to clean pistons and cylinders of a compressor which has been stuck-up. It has the advantage over other cleaners that it may be used in the system in small quantities in normal operation, so that it will prevent sticking-up, even though it may not entirely clean the result of the stick-ups.

I do not believe it would be as good as the tri-sodium phosphate for the repair job which you apparently have in mind.

CHANGING OVER FROM ISOBUTANE

Question 209. Is it good policy to put methyl alcohol into a methyl chloride system if you think you have moisture the same as in "F12" jobs? If not, why not?

In changing an Isobutane job, would it be advisable to use sulphur or methyl chloride without making any changes in the compressor, other than changing the expansion valve setting?

ANSWER: It is decidedly not good policy to put methyl alcohol in a methyl chloride system with the idea of eliminating moisture trouble as may be done with some other refrigerants. Apparently the alcohol tends to go into solution with the methyl chloride rather than the moisture in the system.

You may remember the experience Copeland had with their 1933 direct-driven job. In my estimation the machine they put out might have done nicely had they dried it thoroughly and not depended on some agent in the system to prevent moisture freezing at the expansion valve. In general we may expect the systems will still freeze up with alcohol in them and in addition we may be subject to considerable trouble with corrosion at the expansion valve.

In changing an Isobutane job sulphur dioxide may be used provided that a thorough job of cleaning out all the old refrigerant and oil is done and that dry clean oil and refrigerant is used. The system should have somewhat more capacity with sulphur dioxide than with Isobutane and, of course, the motor will be slightly overloaded. I do not believe, however, that sulphur dioxide is as good a refrigerant as Isobutane; that is, it will be necessary to obtain a slightly lower evaporation temperature to obtain the same temperatures in the evaporator with SO_2 than with Isobutane. This is probably due to the insulating effect of a film of oil on the inside of the evaporating tubes when using SO_2. In changing over to methyl chloride we increase the capacity of the condensing unit considerably and in order to prevent the motor from operating under a continuous heavy overload it will be advisable to change the motor-pulley to a smaller one in order to turn the compressor slower and thereby not overload the motor. The new pulley size should be not more than two-thirds the diameter of the old pulley.

FIGURING DAIRY INSTALLATION

QUESTION 210. I am trying to figure a dairy installation using brine to cool the milk over an aerator. Different jobs we have installed used a great amount of calcium chloride brine, but after reading Mr. George H. Clark's article "Refrigeration Storage" in the October issue of THE REFRIGERATION SERVICE ENGINEER, I would like to use this method in this installation.

Would you send us information on this type of installation? The amount of milk to be cooled is about 500 quarts. The top half of the aerator is cooled by spring water at an average temperature of 50 degrees. The milk, of course, is pasteurized at a temperature of 145 degrees F., and then rapidly lowered in temperature over the aerator, first by the water at the top section and then by the brine to a temperature of 38 degrees.

I would like to know what size compressor unit, amount of calcium brine, barium chloride solution, and length of tubing for both coils in brine tank. I intend to use SO_2.

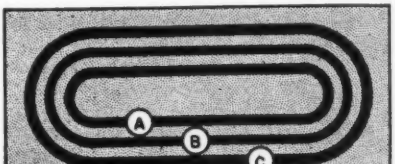

FIG. 1. COIL DESIGN FOR BRINE TANK USED FOR MILK COOLER

A—Inner circulating brine coil
C—Outer circulating brine coil
Both coils in series
B—Refrigerating coil. Liquid in bottom. Top to compressor
D—Thermostat bulb location. Set 17° ON 13° OFF for barium chloride brine
For other brines see question 194 on eutectic solutions in May issue, page 24

ANSWER: In cooling 500 quarts of milk from a temperature of approximately 60 degrees to 38 degrees, the amount of heat to be removed will be about 22,000 B.t.u. and I presume that this amount of heat is to be removed from the milk twice each day. 22,000 B.t.u. might be removed by a one-half ton refrigerating machine in approximately four hours so that a one-horsepower machine water-cooled and having an evaporating temperature of approximately 5 degrees should be adequate if operated from four to five hours for each batch of milk passed through the aerating equipment.

The amount of refrigeration which we must store in this case would have to be in the neighborhood of 25,000 B.t.u. for safety and if we consider the water only which we are to use in making up our eutectic freezing solution, we can count on a heat of fusion of 144 B.t.u. 25,000 divided by this figure will give about 200 pounds of brine

required to be frozen. We probably should not depend on freezing more than one-half of the brine in the tank so it is suggested that we use a tank holding about 400 pounds or more of water. This would be in the neighborhood of 7 cubic feet, which would give us a tank of 2 feet high, 3 feet long and 15 inches wide.

In this tank it is suggested that an oval coil be wound of ½-inch tubing approximately 100 feet long and that this coil be fed by a thermostatic expansion valve at one end, the refrigerant passing through the coil to the outlet which returns to the closest side of the compressor. Two other oval coils should also be wound, one of which should fit inside of the refrigeration coil and be spaced approximately two inches from the refrigeration coil, and should consist of approximately 100 feet or more preferably of ⅝-inch tubing. The other coil should be spaced around the refrigeration coil and this should consist of about 200 feet of the ⅝-inch tubing.

The brine should be frozen around the two ⅝-inch coils due to the refrigeration obtained in the ½-inch refrigeration coil. The brine which is being circulated through the aerator should be circulated through the two ⅝-inch coils in series; and if it is desired to use copper tubing for the ⅝-inch coils, it is suggested that a brine which is non-corrosive be used to circulate through the aerator. If the system is very tight so that no leaks may cause trouble, we may use an alcohol brine or we may use a brine consisting of water and glycerine or of water and Prestone. If calcium chloride brine is used, it may have a harmful effect on our copper tubing, although we have used copper tubing in calcium chloride brines for years. If the tubing were tinned internally and externally, this might be an advantage also when using calcium chloride brine to circulate through the aerator.

If you are going to use sulphur dioxide as the refrigerant, I would suggest that you use an evaporation temperature of approximately 5 degrees if you are going to use a barium chloride brine. This will give a 12 degree temperature difference between the evaporating refrigerant and the freezing brine which should be sufficient. This will require an expansion valve setting of about four inches vacuum.

The brine tank should be insulated on the outside with three or four inches of corkboard or its equivalent and a small brine pump should be used to circulate the brine through the brine coil and the aerator.

An expansion tank may be located in the eutectic freezing tank itself to allow for the increase and decrease in volume due to changing temperatures of the non-freezing brine. Fig. 1 will give an idea as to the type of set-up which may be used.

DISCOLORATION AND ODORS IN MEATS

QUESTION 211. Would like to be advised what causes fresh meat to get a peculiar stale taste and smell after two days in the cooler. It also gets dry and very dark in color.

The cooler is old, but was relined a year ago with waxed paper and new lumber on top. It was painted with four-hour white enamel. Another ceiling was installed changing the dimensions from 7′x6′x10′ to 7′x6′x8′. It is equipped with Peerless flash type coils. The plant is operated by a one-h.p. machine which also pulls a 10 ft. double-duty counter.

Is it possible that the odor and taste in the meat comes from the enamel because it was not thoroughly dried before using, or has it anything to do with the yellow pine lumber used?

As for drying and darkening of meats, is it due to sudden change of temperature caused by this type of coil, or to the low ceiling?

ANSWER: The trouble which you describe I believe may be due to the finish on the inside of the cooler. I recently heard of a similar experience where the meat in a counter turned dark in a very short time after being put in the counter, and all refrigerant connections were checked thoroughly to be sure that there were no refrigerant leaks, and it was finally decided that it would be necessary to exchange the counter for one having a different type of interior finish in order to eliminate the difficulty.

The drying and darkening of meats may be caused, of course, by excess drying of the air in the refrigerator which may be due to too small a coil, and too low a temperature in the coil; too rapid an air circulation may also cause this difficulty. It is doubtful if this would occur with the type of coil which you have. This difficulty is more apt to occur when using a unit cooler type of coil with a direct air blast on the meat. In your particular case I think that the finish in the interior of your refrigerator is responsible for the trouble.

Service Pointer

Better Rotor Lubrication Cures Majestic Trouble

MR. HENRY KRONKE, of New York City, was not satisfied with the usual answer that "nothing could be done about it" when he encountered trouble with Majestic Models 50, 51, 60 and 61. He investigated and experimented and now believes he has found the solution. Here is what Mr. Kronke writes the Editor:

"To most service men, the compressors of Majestic models 50, 51, 60 and 61 have been a source of worry. They are noisy, get too hot and usually there comes a time when they will not pump at all and have to be replaced.

"The theory always has been advanced that the rotor and the walls of the compression chamber were worn, and that nothing could be done about it. However, after observing a number of these compressors and taking them apart for inspection, I find no reason for this belief. Rather, I have come to the conclusion that the trouble is due to insufficient lubrication of the rotor. The crankcase may be full of oil, but this oil cannot reach the rotor except during the idle period when it may back up into the compression chamber.

"To remedy this, I have made provision for better lubrication, and thus am able to save all of these compressors, which otherwise would be junked.

"In the interest of your many readers, I am submitting a description of my method."

Remedy

When an open-type Majestic compressor gets noisy, inefficient, or does not pump at all, it can quickly and permanently be repaired by anyone by providing for better lubrication of the rotor. The only tools and materials required are: a vise, drill, 4 inches of capillary tubing, and a fine screen.

Remove the flywheel and shaft key, drain the oil and take off the back cover, to which the working parts of the compressor are bolted. Clamp this in the vise with the shaft pointing up. Do not remove the bolts or break the welds which hold the compressor proper together, as the compressor may bind after it is assembled again.

Facing the top plate, locate the center between the two lower bolts on the left side (on the opposite side from the tubing) and mark it. With a ruler on this mark and against the lower edge of the shaft bearing, scratch a line on this plate. Now measure downward from the beginning of this line $1\frac{9}{16}$ of an inch on the side of the compressor and make a punchmark for drilling. With a drill of the same size as the tubing to be entered here later, drill parallel with the

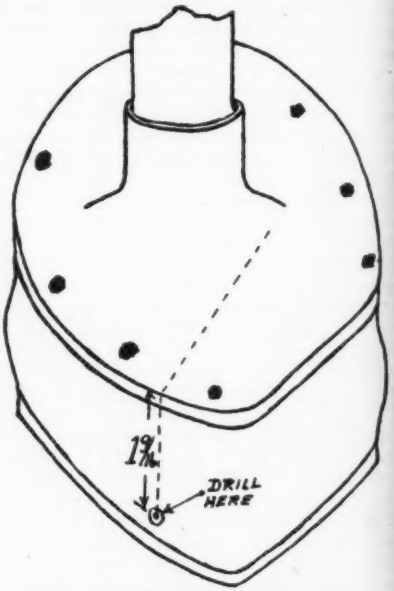

FIG. 1. LOCATION TO DRILL HOLE.

line scratched on the top plate until the suction port has been tapped. This should happen before the drill is in $\frac{3}{4}$ of an inch. Do not drill more than $\frac{3}{4}$ of an inch as the rotor may be damaged.

Into this hole push a very fine bore capillary tubing and punch the edges around the hole against the tubing to keep it in place. The free end of the tubing should be nearly pinched shut. There will be an average pressure differential of 70 lbs. between the two tube ends, and the tiniest hole will admit enough oil for the rotor. Bend the tubing down so that its free end will be under the rotor. To prevent dirt from plugging the tube, a fine screen should be soldered around its end.

After cleaning the shaft shoulder and the seal face, the compressor is ready for assembly.

The compressor should be run with a 100-lb. head pressure in the shop. Any pounding at this pressure indicates that too much oil is being admitted to the rotor and the tubing will have to be pinched more.

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Refrigerant and Lubrication Data

for Household Refrigerating Units

Continued from the June Issue

By L. K. Wright, Mem. A.S.R.E.

THE following pages provide data for quick and ready reference, covering the more common household models of American units manufactured during the years of 1933, 1934, 1935 and 1936. In a few instances, data on the exact weight of oil and refrigerants was not secured, and space has been left to insert this data when it is available.

In order to condense the data, the following abbreviations have been used:

SO	— Sulphur Dioxide	F21	— F-21
MC	— Methyl Chloride	F114	— F-114
Iso	— Isobutane	MF	— Methyl Formate
F12	— F-12 (Freon)	Car	— Carrene
F14	— F-14	EC	— Ethyl Chloride

The refrigerant charge given in each case is the correct quantity of refrigerant for proper operation. It is not the pump-down capacity of receiver. Oils are specified by weight or volume. It must be borne in mind that the oil must be chosen which is correct for the refrigerant, sulphur dioxide using the lowest viscosity grade.

Under the heading of the make of machine will be found the various models and their data covering each year.

Information on other machines appears in the June issue

Make	Model No.	Refrigerant Used	Refrigerant Charge	Oil	Motor Size
Kelvinator 1933	**Kelvinator Corp. 14250 Plymouth Rd., Detroit, Mich.**				
	D-55	SO	1 lb. 8 ozs.	1 lb. 10 ozs.	1/4
	D-65	SO	1 lb. 8 ozs.	1 lb. 10 ozs.	1/4
	D-75	SO	1 lb. 8 ozs.	1 lb. 10 ozs.	1/4
	D-90	SO	1 lb. 10 ozs.	1 lb. 10 ozs.	1/3
	D-120	SO	1 lb. 10 ozs.	1 lb. 10 ozs.	1/3
	D-150	SO	1 lb. 14 ozs.	2 lbs. 4 ozs.	1/3
	D-230	SO	1 lb. 14 ozs.	2 lbs. 4 ozs.	1/3
	K-40	SO	3 lbs. 5 ozs.	1 lb. 3 ozs.	1/10
	K-40S	SO	3 lbs. 5 ozs.	1 lb. 3 ozs.	1/10
	K-40N	SO	3 lbs. 5 ozs.	1 lb. 3 ozs.	1/10
	K-40NS	SO	3 lbs. 5 ozs.	1 lb. 3 ozs.	1/6
	K-50	SO	3 lbs. 5 ozs.	1 lb. 3 ozs.	1/10
	K-50S	SO	3 lbs. 5 ozs.	1 lb. 10 ozs.	1/4
	K-60	SO	3 lbs. 5 ozs.	1 lb. 10 ozs.	1/6
	K-60S	SO	3 lbs. 5 ozs.	1 lb. 10 ozs.	1/4

Kelvinator—Continued on Next Page

Make	Model No.	Refrigerant Used	Refrigerant Charge	Oil	Motor Size	
KELVINATOR 1933—*Continued from Preceding Page*						
	K-80	SO	3 lbs. 10 ozs.	1 lb. 10 ozs.	1/4	
	PK-40	SO	3 lbs. 5 ozs.	1 lb. 3 ozs.	1/10	○
	PK-40S	SO	3 lbs. 5 ozs.	1 lb. 3 ozs.	1/6	
	PK-50	SO	3 lbs. 5 ozs.	1 lb. 3 ozs.	1/10	
	PK-50S	SO	3 lbs. 5 ozs.	1 lb. 10 ozs.	1/4	
	PK-60	SO	3 lbs. 10 ozs.	1 lb. 10 ozs.	1/6	
	PK-60S	SO	3 lbs. 10 ozs.	1 lb. 10 ozs.	1/4	
	PK-70	SO	3 lbs. 10 ozs.	1 lb. 10 ozs.	1/4	
	PK-80	SO	3 lbs. 10 ozs.	1 lb. 10 ozs.	1/4	
	R-42	SO	3 lbs. 2 ozs.	1 lb. 3 ozs.	1/10	
	RE-42	SO	3 lbs. 2 ozs.	1 lb. 3 ozs.	1/10	○
	R-42S	SO	3 lbs. 2 ozs.	1 lb. 3 ozs.	1/6	
	RE-42S	SO	3 lbs. 2 ozs.	1 lb. 3 ozs.	1/6	
	R-42N	SO	3 lbs.	1 lb. 3 ozs.	1/10	
	R-42NS	SO	3 lbs.	1 lb. 3 ozs.	1/10	
	R-53	SO	3 lbs. 5 ozs.	1 lb. 3 ozs.	1/6	
	R-64	SO	3 lbs. 5 ozs.	1 lb. 10 ozs.	1/6	
	R-64S	SO	3 lbs. 5 ozs.	1 lb. 10 ozs.	1/4	
	R-75	SO	3 lbs. 5 ozs.	1 lb. 10 ozs.	1/4	○
1934						
	CKN	SO	1 lb. 4 ozs.	14 ozs.	1/8	
	V	SO	2 lbs. 13 ozs.	19 ozs.	1/6	
	N	SO	2 lbs. 13 ozs.	19 ozs.	1/6	
	A-5	SO	3 lbs. 2 ozs.	19 ozs.	1/6	
	A-5-S	SO	2 lbs. 15 ozs.	26 ozs.	1/6	
	NA	SO	3 lbs. 2 ozs.	19 ozs.	1/6	
	NAS	SO	2 lbs. 15 ozs.	26 ozs.	1/6	
	NB	SO	2 lbs. 15 ozs.	26 ozs.	1/6	
	NBS	SO	2 lbs. 15 ozs.	26 ozs.	1/4	
	D-2	SO	1 lb. 5 ozs.	26 ozs.	1/4	
	D-3	SO	1 lb. 5 ozs.	26 ozs.	1/4	
	D-4	SO	1 lb. 7 ozs.	26 ozs.	1/3	
	D-5	SO	1 lb. 7 ozs.	26 ozs.	1/3	
	D-6	SO	1 lb. 11 ozs.	32 ozs.	1/3	
	D-7	SO	1 lb. 11 ozs.	32 ozs.	1/3	
	SA	SO	3 lbs. 2 ozs.	19 ozs.	1/6	
	SAS	SO	2 lbs. 15 ozs.	26 ozs.	1/6	
	SB	SO	3 lbs. 2 ozs.	26 ozs.	1/6	
	SBS	SO	3 lbs. 2 ozs.	26 ozs.	1/4	
	SC	SO	3 lbs. 2 ozs.	26 ozs.	1/4	
	PA	SO	3 lbs. 2 ozs.	19 ozs.	1/6	
	PAS	SO	3 lbs. 4 ozs.	26 ozs.	1/4	○
	PB	SO	3 lbs. 7 ozs.	26 ozs.	1/6	
	PBS	SO	3 lbs. 4 ozs.	26 ozs.	1/4	
	PC	SO	3 lbs. 7 ozs.	26 ozs.	1/4	
	PD	SO	3 lbs. 7 ozs.	26 ozs.	1/4	
1935						
	D-513	SO	2 lbs. 14 ozs.	19 ozs.	1/6	
	D-513S	SO	2 lbs. 14 ozs.	26 ozs.	1/4	○
	D-617	SO	3 lbs.	26 ozs.	1/6	
	D-617S	SO	3 lbs.	26 ozs.	1/4	
	D-736	SO	3 lbs.	26 ozs.	1/4	
	D-873	SO	3 lbs.	26 ozs.	1/4	
	SD-658	SO	1 lb. 1 oz.	26 ozs.	1/4	
	SD-782	SO	1 lb. 1 oz.	26 ozs.	1/4	
	SD-903	SO	1 lb. 1 oz.	26 ozs.	1/3	
	SD-1268	SO	1 lb. 3 ozs.	26 ozs.	1/3	
	SD-1525	SO	1 lb. 7 ozs.	32 ozs.	1/3	○
	SD-2332	SO	1 lb. 7 ozs.	32 ozs.	1/3	
	K-300	SO	1 lb. 9 ozs.	19 ozs.	1/6	
	K-425	SO	2 lbs. 6 ozs.	19 ozs.	1/6	
	K-425S	SO	2 lbs. 3 ozs.	26 ozs.	1/6	
	K-485	SO	2 lbs. 12 ozs.	19 ozs.	1/6	

Kelvinator—Continued on Next Page

Make	Model No.	Refrigerant Used	Refrigerant Charge	Oil	Motor Size
KELVINATOR 1935—*Continued from Preceding Page*					
	K-485S	SO	2 lbs. 2 ozs.	26 ozs.	1/6
	K-541	SO	2 lbs. 9 ozs.	19 ozs.	1/6
	K-541S	SO	2 lbs. 3 ozs.	26 ozs.	1/6
	K-650	SO	2 lbs. 3 ozs.	26 ozs.	1/6
	K-650S	SO	2 lbs. 3 ozs.	26 ozs.	1/4
	K-760	SO	2 lbs. 8 ozs.	26 ozs.	1/4
	KX-275	SO	2 lbs. 6 ozs.	14 ozs.	1/8
	P-425	SO	2 lbs. 12 ozs.	19 ozs.	1/6
	P-425S	SO	2 lbs. 9 ozs.	26 ozs.	1/6
	P-541	SO	2 lbs. 9 ozs.	19 ozs.	1/6
	P-541S	SO	2 lbs. 3 ozs.	26 ozs.	1/6
	P-650	SO	2 lbs. 3 ozs.	26 ozs.	1/6
	P-650S	SO	2 lbs. 3 ozs.	26 ozs.	1/4
	P-760	SO	2 lbs. 8 ozs.	26 ozs.	1/4
1936					
	K3-36	SO	1 lb. 8 ozs.	19 ozs.	1/6
	K4-36	SO	2 lbs. 1 oz.	19 ozs.	1/6
	K5-36	SO	2 lbs. 3 ozs.	19 ozs.	1/6
	K6-36	SO	2 lbs. 1 oz.	24 ozs.	1/6
	K7-36	SO	2 lbs. 4 ozs.	24 ozs.	1/6
	KS5-36	SO	2 lbs. 3 ozs.	19 ozs.	1/6
	KS6-36	SO	2 lbs. 4 ozs.	24 ozs.	1/6
	PK5-36	SO	2 lbs. 3 ozs.	19 ozs.	1/6
	PK6-36	SO	2 lbs. 1 oz.	24 ozs.	1/6
	PK7-36	SO	2 lbs. 4 ozs.	24 ozs.	1/6
	SD7-36	SO	1 lb. 15 ozs.	24 ozs.	1/6
	SD9-36	SO	1 lb. 15 ozs.	24 ozs.	1/4
	SD13-36	SO	2 lbs. 6 ozs.	24 ozs.	1/4
	SD17-36	SO	2 lbs. 12 ozs.	24 ozs.	1/4
Keokuk 1933	**Keokuk Refrigerating Co. Keokuk, Iowa**				
	4-L	SO	2 lbs.	1 qt.	1/6
	5-L	SO	2 lbs.	1 qt.	1/6
	6-L	SO	2½ lbs.	1 qt.	1/6
	8-L	SO	2¾ lbs.	1 qt.	1/6
	LT-4	SO	2 lbs.	1 qt.	1/6
	LT-6	SO	2½ lbs.	1 qt.	1/6
	LT-8	SO	2¾ lbs.	1 qt.	1/6
	PT-6	SO	2½ lbs.	1 qt.	1/6
	PT-8	SO	2¾ lbs.	1 qt.	1/6
(Above models turned out in 1932 and 1933.)					
1934					
	2447	SO	2 lbs.	1 qt.	1/6
	L-404	SO	2 lbs.	1 qt.	1/6
	L-504	SO	2¼ lbs.	1 qt.	1/6
	P-504	SO	2¼ lbs.	1 qt.	1/6
	L-604	SO	2½ lbs.	1 qt.	1/6
	P-604	SO	2½ lbs.	1 qt.	1/6
	L-704	SO	2¾ lbs.	1 qt.	1/6
	P-704	SO	2¾ lbs.	1 qt.	1/6
Lectrik-Ice (& Challenger) 1933	**Uniflow Mfg. Co. Erie, Pa.** (See Challenger)				
	D-42	SO	1¾ lbs.	8 ozs.	1/6
	D-52	SO	1¾ lbs.	24 ozs.	1/6
	D-63	SO	1¾ lbs.	24 ozs.	1/6
	D-84	SO	1¾ lbs.	24 ozs.	1/5
	P-42	SO	1¾ lbs.	8 ozs.	1/6

Lectrik-Ice—Continued on Next Page

Make	Model No.	Refrigerant Used	Refrigerant Charge	Oil	Motor Size
LECTRIK-ICE—*Continued from Preceding Page*					
	P-52	SO	1¾ lbs.	24 ozs.	1/6
	P-63	SO	1¾ lbs.	24 ozs.	1/6
	P-84	SO	1¾ lbs.	24 ozs.	1/5
	P-105	SO	1¾ lbs.	40 ozs.	1/4
	TS-40	SO	1¾ lbs.	8 ozs.	1/6
	TS-45	SO	1¾ lbs.	8 ozs.	1/6
	S-45	SO	3¼ lbs.	8 ozs.	1/6
	S-60	SO	4 lbs.	8 ozs.	1/6
1934					
	M-45	MC	1¼ lbs.	8 ozs.	1/6
	M-60	MC	1¼ lbs.	8 ozs.	1/6
	P-42	SO	1¾ lbs.	24 ozs.	1/6
	P-52	SO	1¾ lbs.	24 ozs.	1/6
	D-63	SO	1¾ lbs.	24 ozs.	1/6
	P-63	SO	1¾ lbs.	24 ozs.	1/6
	P-105	SO	1¾ lbs.	40 ozs.	1/4
1935					
	DM-5	MC	1 lb. 8 ozs.	12 ozs.	1/6
	DM-6	MC	1 lb. 12 ozs.	12 ozs.	1/4
	DM-7	MC	1 lb. 12 ozs.	12 ozs.	1/4
	DM-8	MC	1 lb. 12 ozs.	12 ozs.	1/4
	M-45	MC	1 lb. 8 ozs.	12 ozs.	1/6
	M-60	MC	1 lb. 8 ozs.	12 ozs.	1/6
1936					
	M-45	MC	1 lb. 12 ozs.	8 ozs.	1/6
	M-60	MC	1 lb. 12 ozs.	8 ozs.	1/6
	DM-5	MC	1 lb. 12 ozs.	8 ozs.	1/6
	DM-6	MC	1 lb. 12 ozs.	24 ozs.	1/4
	DM-7	MC	1 lb. 12 ozs.	24 ozs.	1/4
	DM-8	MC	1 lb. 12 ozs.	24 ozs.	1/4

The "M" models were sold under the Challenger name, while the "DM" models were sold under the Lectrik-Ice trademark.

Leonard

1933

Leonard Refrigerator Co.
Subsidiary of Kelvinator Corp.
14250 Plymouth Rd., Detroit, Mich.

L-451	SO	3 lbs. 5 ozs.	19 ozs.	1/10, 1/6
L-451S	SO	3 lbs. 5 ozs.	19 ozs.	1/6
PL-451	SO	3 lbs. 5 ozs.	19 ozs.	1/10, 1/6
PL-451S	SO	3 lbs. 5 ozs.	19 ozs.	1/6
L-551	SO	3 lbs. 5 ozs.	19 ozs.	1/6
L-551S	SO	3 lbs. 5 ozs.	26 ozs.	1/4
PL-551	SO	3 lbs. 5 ozs.	19 ozs.	1/6
PL-551S	SO	3 lbs. 5 ozs.	26 ozs.	1/4
L-651	SO	3 lbs. 10 ozs.	26 ozs.	1/6
L-651S	SO	3 lbs. 10 ozs.	26 ozs.	1/4
PL-751	SO	3 lbs. 10 ozs.	26 ozs.	1/4
L-752	SO	3 lbs. 10 ozs.	26 ozs.	1/4
PL-952	SO	3 lbs. 14 ozs.	26 ozs.	1/4
L-424	SO	3 lbs.	19 ozs.	1/10, 1/6
L-424S	SO	3 lbs.	19 ozs.	1/6
L-425	SO	3 lbs.	19 ozs.	1/10, 1/6
L-425S	SO	3 lbs.	19 ozs.	1/6
L-531	SO	3 lbs. 5 ozs.	19 ozs.	1/6
L-531S	SO	3 lbs. 5 ozs.	26 ozs.	1/6
L-641	SO	3 lbs. 5 ozs.	26 ozs.	1/6
L-641S	SO	3 lbs. 5 ozs.	26 ozs.	1/4
LBW-15	SO	2 lbs. 6 ozs.	26 ozs.	1/4
LBWC-25	SO	2 lbs. 6 ozs.	26 ozs.	1/4
LCW-35	SO	1 lb. 15 ozs.	19 ozs.	1/4

Leonard—Continued on Next Page

Make	Model No.	Refrigerant Used	Refrigerant Charge	Oil	Motor Size
LEONARD 1933—*Continued from Preceding Page*					
	LCW-45	SO	1 lb. 12 ozs.	26 ozs.	1/4
	LCWC-55	SO	1 lb. 15 ozs.	19 ozs.	1/4
	LCWC-65	SO	1 lb. 12 ozs.	26 ozs.	1/4
	LCW-85	SO	1 lb. 15 ozs.	19 ozs.	1/4
	LCW-95	SO	1 lb. 12 ozs.	26 ozs.	1/4
1934					
	SL-1	SO	2 lbs. 12 ozs.	1 lb. 3 ozs.	1/6
	SL-15	SO	3 lbs. 1 oz.	1 lb. 10 ozs.	1/6
	SL-15S	SO	3 lbs. 1 oz.	1 lb. 3 ozs.	1/6
	SL-2	SO	3 lbs. 1 oz.	1 lb. 3 ozs.	1/6
	SL-2-S	SO	3 lbs. 1 oz.	1 lb. 10 ozs.	1/6
	SL-3	SO	3 lbs. 1 oz.	1 lb. 10 ozs.	1/6
	SL-3S	SO	3 lbs. 1 oz.	1 lb. 10 ozs.	1/4
	SP-2	SO	3 lbs. 1 oz.	1 lb. 3 ozs.	1/6
	SP-2S	SO	3 lbs. 1 oz.	1 lb. 10 ozs.	1/4
	LD-2	SO	3 lbs. 1 oz.	1 lb. 10 ozs.	1/6
	LD-2S	SO	3 lbs. 1 oz.	1 lb. 10 ozs.	1/4
	LD-3	SO	3 lbs. 6 ozs.	1 lb. 10 ozs.	1/6
	LD-3S	SO	3 lbs. 6 ozs.	1 lb. 10 ozs.	1/4
	PD-2	SO	3 lbs. 1 oz.	1 lb. 10 ozs.	1/6
	PD-2S	SO	3 lbs. 1 oz.	1 lb. 10 ozs.	1/4
	PD-3	SO	3 lbs. 6 ozs.	1 lb. 10 ozs.	1/6
	PD-3S	SO	3 lbs. 6 ozs.	1 lb. 10 ozs.	1/4
	PD-4	SO	3 lbs. 6 ozs.	1 lb. 10 ozs.	1/4
	PD-5	SO	3 lbs. 10 ozs.	1 lb. 10 ozs.	1/4
	LX-5S	SO	2 lbs. 11 ozs.	1 lb. 10 ozs.	1/6
	LX-5	SO	2 lbs. 14 ozs.	1 lb. 3 ozs.	1/6
	T-1	SO	2 lbs. 9 ozs.	1 lb. 3 ozs.	1/6
	CLS	SO	1 lb. 14 ozs.	1 lb. 3 ozs.	1/8
1935					
	L-300	SO	2 lbs. 6 ozs.	1 lb.	1/8
	LA	SO	2 lbs. 6 ozs.	1 lb.	1/8
	LAS	SO	2 lbs. 2 ozs.	1 lb.	1/6
	LD-553	SO	2 lbs. 12 ozs.	1 lb. 3 ozs.	1/6
	LD-553S	SO	2 lbs. 9 ozs.	1 lb. 10 ozs.	1/6
	LX-275	SO	2 lbs. 6 ozs.	1 lb.	1/8
	PD-588	SO	2 lbs. 14 ozs.	1 lb. 10 ozs.	1/6
	PD-588S	SO	2 lbs. 14 ozs.	1 lb. 10 ozs.	1/4
	PD-704	SO	3 lbs.	1 lb. 10 ozs.	1/6
	PD-704S	SO	3 lbs.	1 lb. 10 ozs.	1/4
	PD-896	SO	3 lbs.	1 lb. 10 ozs.	1/4
	PD-1059	SO	3 lbs. 4 ozs.	1 lb. 10 ozs.	1/4
	SL-435	SO	2 lbs. 6 ozs.	1 lb.	1/6
	SL-435S	SO	2 lbs. 2 ozs.	1 lb. 10 ozs.	1/6
	SL-525	SO	2 lbs. 12 ozs.	1 lb. 3 ozs.	1/6
	SL-525S	SO	2 lbs. 9 ozs.	1 lb. 10 ozs.	1/6
	SL-600	SO	2 lbs. 14 ozs.	1 lb. 10 ozs.	1/6
	SL-600S	SO	2 lbs. 14 ozs.	1 lb. 10 ozs.	1/4
	SL-721	SO	2 lbs. 14 ozs.	1 lb. 10 ozs.	1/6
	SL-721S	SO	2 lbs. 14 ozs.	1 lb. 10 ozs.	1/4
	SP-525	SO	2 lbs. 12 ozs.	1 lb. 3 ozs.	1/6
	SP-525S	SO	2 lbs. 9 ozs.	1 lb. 10 ozs.	1/6
	SP-600	SO	2 lbs. 14 ozs.	1 lb. 10 ozs.	1/6
	SP-600S	SO	2 lbs. 14 ozs.	1 lb. 10 ozs.	1/4
1936					
	LS5-36	F-12	27 ozs.	15 ozs.	1/8
	LS6-36	F-12	28 ozs.	15 ozs.	1/8
	L3-36	F-12	22 ozs.	15 ozs.	1/8
	L4-36	F-12	26 ozs.	15 ozs.	1/8
	L5-36	F-12	28 ozs.	15 ozs.	1/8
	L6-36	F-12	28 ozs.	15 ozs.	1/8
	L7-36	F-12	30 ozs.	15 ozs.	1/6
	P5-36	F-12	28 ozs.	15 ozs.	1/8
	P6-36	F-12	28 ozs.	15 ozs.	1/8
	P7-36	F-12	30 ozs.	15 ozs.	1/6
	P10-36	F-12	48 ozs.	24 ozs.	1/4

Make	Model No.	Refrigerant Used	Refrigerant Charge	Oil	Motor Size
Liberty 1933	**Liberty Refrigerator Corp. 241 Georgia Ave., Providence, R. I. (Discontinued manufacture of units in 1935)**				
	LE-36	MC	1.3 lbs.	0.63 pt.	1/6
	LE-40	MC	1.3 lbs.	0.63 pt.	1/6
	LP-45	MC	1.3 lbs.	0.63 pt.	1/6
	LP-55	MC	1.3 lbs.	0.63 pt.	1/6
	LP-65	MC	1.3 lbs.	0.63 pt.	1/6
	LP-80	MC	1.3 lbs.	0.63 pt.	1/6
	LP-350	MC	1.3 lbs.	0.63 pt.	1/6
	LP-400	MC	1.3 lbs.	0.63 pt.	1/6
	LP-450	MC	1.3 lbs.	0.63 pt.	1/6
	LP-550	MC	1.3 lbs.	0.63 pt.	1/6
	LP-650	MC	1.3 lbs.	0.63 pt.	1/6
	LP-800	MC	1.3 lbs.	0.63 pt.	1/6
	1934				
	A-4	MC	1.2 lbs.	0.7 pt.	1/6
	D-4	MC	1.2 lbs.	0.7 pt.	1/6
	D-5	MC	1.3 lbs.	0.7 pt.	1/6
	D-6	MC	1.3 lbs.	0.7 pt.	1/6
	P-5	MC	1.3 lbs.	0.7 pt.	1/6
	P-6	MC	1.3 lbs.	0.7 pt.	1/6
	D-75	MC	1.5 lbs.	0.7 pt.	1/6
	P-75	MC	1.5 lbs.	0.7 pt.	1/6
	P-85	MC	1.5 lbs.	0.7 pt.	1/4
	P-100	MC	1.6 lbs.	0.7 pt.	1/4
	1935				
	A-3	MC	1 lb.	1 pt.	1/6
	A-4	MC	1 lb.	1 pt.	1/6
	A-6	MC	1 lb.	1 pt.	1/6
	D-5	MC	1 lb.	1 pt.	1/6
	D-6	MC	1 lb.	1 pt.	1/6
	D-75	MC	1 lb.	1 pt.	1/6
	P-5	MC	1 lb.	1 pt.	1/6
	P-6	MC	1 lb.	1 pt.	1/6
	P-75	MC	1 lb.	1 pt.	1/6
	P-85	MC	1 lb. 8 ozs.	1½ pts.	1/5
	P-100	MC	1 lb. 8 ozs.	1½ pts.	1/5
	The previous year Liberty units were charged with methyl chloride. The 1935 units listed above were generally charged with methyl chloride as given, but sulphur dioxide was used in some cases. Therefore, some Liberty units will be found charged with sulphur dioxide, in which case the charge will be 1.7 lbs. for all units save P-85 and P-100, in which charge is 2.25 lbs.				
Majestic 1933	**Grigsby-Grunow Co. 5801 Dickens Ave., Chicago, Ill.**				
	450	SO	1¼ lbs.	31 ozs.	1/8
	500	SO	3½ lbs.	1½ qts.	1/6
	700	SO	3¾ lbs.	1½ qts.	1/6
	900	SO	4 lbs.	1½ qts.	1/6
	1200	SO	7½ lbs.	3 qts.	(2) 1/6
	1400	SO	7½ lbs.	3 qts.	(2) 1/6
Major 1934	**Major Appliance Corp., Chicago, Ill. (Subsidiary of Sunbeam Electric Mfg. Co., Evansville, Ind.)**				
	P-856	SO	1½ lbs.	1 pt.	1/4
	P-628	SO	1½ lbs.	1 pt.	1/5
	L-628	SO	1½ lbs.	1 pt.	1/5
	P-526	SO	1½ lbs.	1 pt.	1/6
	L-526	SO	1½ lbs.	1 pt.	1/6
	L-432	SO	1½ lbs.	1 pt.	1/6

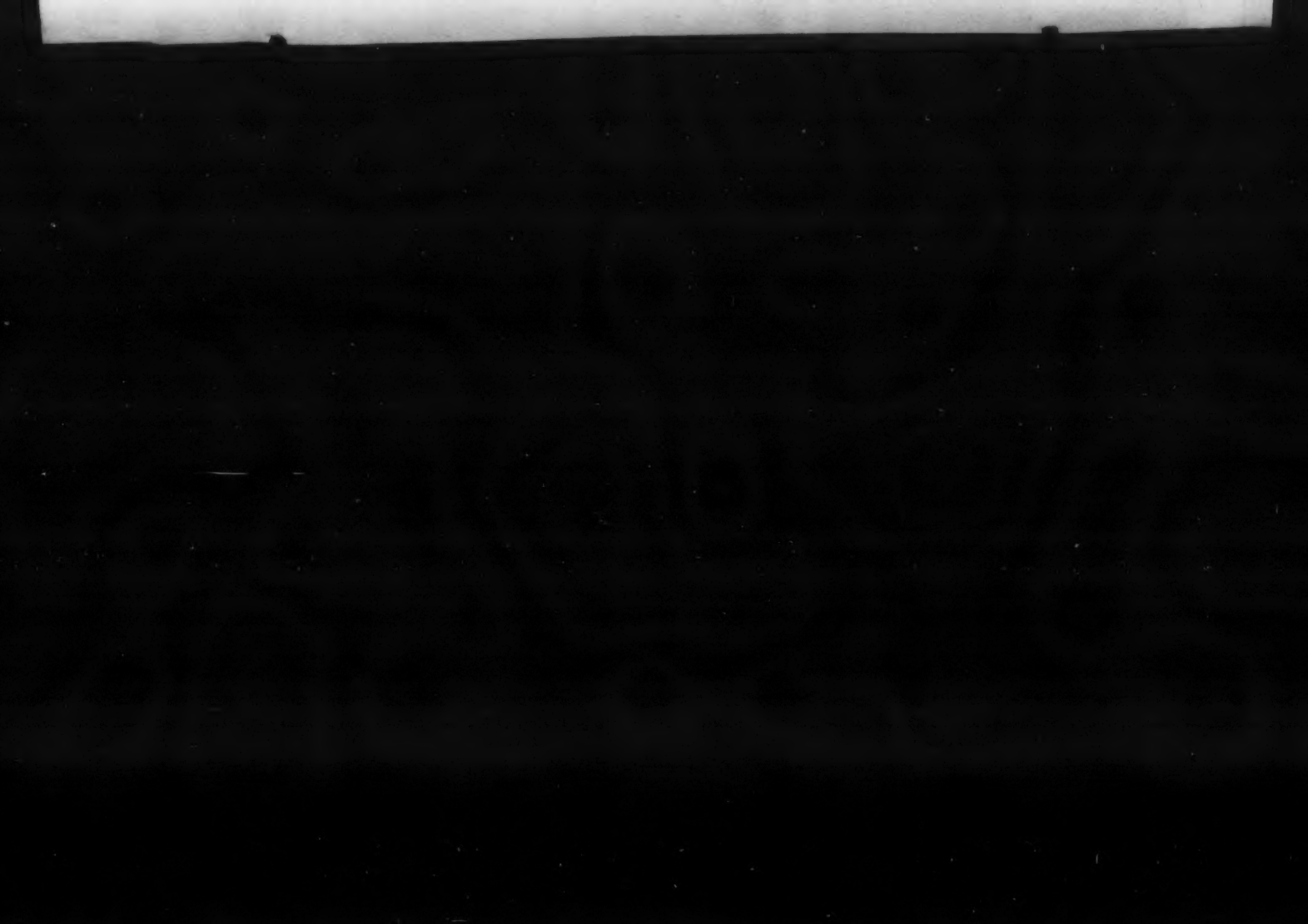
Major—Continued on Next Page

Make	Model No.	Refrigerant Used	Refrigerant Charge	Oil	Motor Size
MAJOR—*Continued from Preceding Page*					
			1935		
	L-432	SO	1 lb. 14 ozs.	1 pt.	1/6
	L-526	SO	1 lb. 14 ozs.	1 pt.	1/6
	L-626	SO	1 lb. 14 ozs.	1 pt.	1/5
	P-526	SO	1 lb. 14 ozs.	1 pt.	1/6
	P-626	SO	1 lb. 14 ozs.	1 pt.	1/5
	P-856	SO	1 lb. 14 ozs.	1 pt.	1/4
Mayflower	Mayflower, Inc.				
1933	St. Paul, Minn.				
	G-5	SO	4½ lbs.	¾ pt.	1/6
	G-6	SO	4½ lbs.	1 pt.	1/5
	G-7	SO	5½ lbs.	1 pt.	1/5
	G-45	SO	4½ lbs.	¾ pt.	1/6
	GP-5	SO	4½ lbs.	1 pt.	1/6
	GP-6	SO	4½ lbs.	1 pt.	1/5
	GP-7	SO	5½ lbs.	1 pt.	1/5
	GP-11	SO	8 lbs.	1 pt.	1/4
			1934		
	H-7	SO	5½ lbs.	1 pt.	1/5
	HP-7	SO	5½ lbs.	1 pt.	1/5
	H-6	SO	4½ lbs.	1 pt.	1/6
	HP-6	SO	4½ lbs.	1 pt.	1/6
	HS-6	SO	4½ lbs.	¾ pt.	1/6
	HS-45	SO	4 lbs.	¾ pt.	1/6
			1935		
	M-505	MC	1 lb. 4 ozs.	⅞ pt.	1/6
	M-635	MC	1 lb. 4 ozs.	⅞ pt.	1/6
	M-755	MC	1 lb. 4 ozs.	⅞ pt.	1/6
	M-955	MC	1 lb. 4 ozs.	⅞ pt.	1/5
	Above models were manufactured by Trupar Mfg. Co.				
			1936		
	G-46	SO	4 lbs.	18 ozs.	1/6
	G-56	SO	4 lbs.	18 ozs.	1/6
	G-66	SO	4 lbs. 8 ozs.	18 ozs.	1/6
	G-86	SO	5 lbs.	18 ozs.	1/4
	GP-66	SO	4 lbs. 8 ozs.	18 ozs.	1/6
	GP-86	SO	5 lbs.	18 ozs.	1/4
	(Above models employed Tecumseh compressors)				
M & E (Merchant & Evans)					
1933	Merchant & Evans Co. 21st & Washington Aves., Philadelphia, Pa.				
	SL-46	SO	1½ lbs.	8 ozs.	1/6
	SL-57	SO	1½ lbs.	8 ozs.	1/6
	SL-67	SO	1½ lbs.	8 ozs.	1/6
	SP-57	SO	1½ lbs.	8 ozs.	1/6
	SP-83	SO	1½ lbs.	8 ozs.	1/6
	TL-46	SO	1½ lbs.	8 ozs.	1/6
			1934		
	D-406	SO	1½ lbs.	8 ozs.	1/6
	D-507	SO	1½ lbs.	8 ozs.	1/6

M & E—Continued on Next Page

Make	Model No.	Refrigerant Used	Refrigerant Charge	Oil	Motor Size
M & E 1934—*Continued from Preceding Page*					
	D-607	SO	1½ lbs.	8 ozs.	1/6
	LE-4	SO	1½ lbs.	8 ozs.	1/6
	P-507	SO	1½ lbs.	8 ozs.	1/6
	P-607	SO	1½ lbs.	8 ozs.	1/6
	P-803	SO	1½ lbs.	8 ozs.	1/6
1935					
	D-504	SO	1 lb. 8 ozs.	8 ozs.	1/6
	D-604	SO	1 lb. 8 ozs.	8 ozs.	1/6
	L-404	SO	1 lb. 8 ozs.	8 ozs.	1/6
	P-504	SO	1 lb. 8 ozs.	8 ozs.	1/6
	P-605	SO	1 lb. 8 ozs.	8 ozs.	1/6
	P-704	SO	1 lb. 8 ozs.	8 ozs.	1/6
1936					
	4-S	SO	2 lbs.	8 ozs.	1/6
	66-S	SO	2 lbs.	8 ozs.	1/6
	91-S	SO	1 lb. 12 ozs.	8 ozs.	1/5
Midwest 1936	Midwest Radio Corp. Cincinnati, Ohio				
	4-S	MC	10 ozs.	5 ozs.	1/6
	5-S	MC	10 ozs.	5 ozs.	1/6
	6-D	MC	10 ozs.	5 ozs.	1/6
	7-D	MC	10 ozs.	5 ozs.	1/6
	8-D	MC	10 ozs.	5 ozs.	1/6
Napier 1933	Metal Saw & Machine Co., Inc. 40 Napier St., Springfield, Mass. (Discontinued manufacture of refrigeration units in 1933)				
	A-4	MC	2 lbs.	1½ pts.	1/6
	A-5	MC	2½ lbs.	1½ pts.	1/6
	A-6	MC	2½ lbs.	1½ pts.	1/6
	A-8	MC	3 lbs.	1½ pts.	1/6
Above units were produced in 1932 and 1933. These were the only machines manufactured by this organization.					
National 1935	National Refrigeration Corp. Dayton, Ohio (National now inactive in refrigeration business)				
	N-46	SO	3 lbs. 6 ozs.	1½ pts.	1/6
	N-54	SO	3 lbs. 6 ozs.	1½ pts.	1/6
	N-66	SO	4 lbs. 6 ozs.	1½ pts.	1/6
	N-77	SO	5 lbs.	1½ pts.	1/4
	N-87	SO	5 lbs.	1½ pts.	1/4
Niagara	(See Dayton)				
Norge 1933	Norge Corp., Division of Borg-Warner Corp. 670 E. Woodbridge St., Detroit, Mich.				
	A-44	SO	5 lbs.	30 ozs.	1/6
	AP-44	SO	5 lbs.	30 ozs.	1/6
	D-5	SO	5 lbs. 8 ozs.	30 ozs.	1/6

Norge—Continued on Page 45



Rigid Inspection Safeguards ... and YOU

Valve seats go under the microscope.

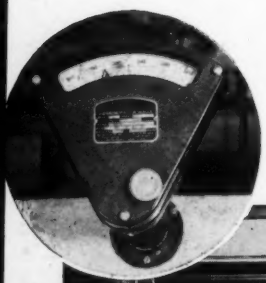
One Inspector for Every 5 Production Men

Inspection rules Production throughout the Fedders plant. In effect, every Fedders production man has an inspector practically at his elbow. The exact ratio is one inspector for every five production men throughout the refrigeration division.

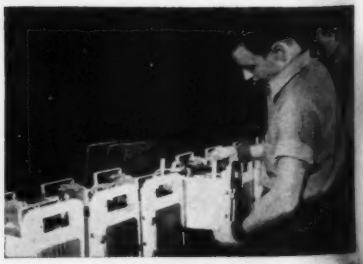
"Go" and "No Go"

The "GO" and "NO GO" ... Fedders inspectors is obeyed with even more respect than the traffic officer's command at the busiest metropolitan intersection.

RIGHT: Valve seats are tested for hardness by the scleroscope.



RIGHT: Series FF-B Evaporators receiving final inspection before packing.



Showing two truck loads of automatic expansion valves in dehydrating oven with 28 inch vacuum lines connected to each. Close up of thermometer dial shows temperature in dehydrating oven.

Cartridge needle seats are inspected for accurate length within a few thousandths of an inch.

ars FEDDERS QUALITY
YUR REPUTATION

Fedders precision begins with the selection of materials and specification of its analysis in accordance with the function of every part. Precision is engineered into every step of machining, assembly, testing, and inspection.

Measurements are made in terms of split hairs. Not pounds, not ounces—only the extreme accuracy of grams is accepted as the unit of weight in measuring the amount of vapor charge in the power elements of Fedders Thermostatic Expansion Valves. Even the temperature in Fedders dehydrating ovens is held within limits of plus and minus one degree Fahrenheit.

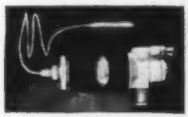
Fedders precision manufacturing and rigid inspection are important not only for what they are, but for what they accomplish in the field. Precision performance is the result of precision manufacture added to correct engineering.

Built with the precision of fine instruments, — Fedders Heat Transfer Equipment sells AND STAYS SOLD!

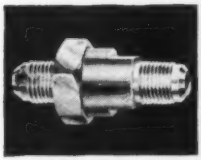
And you pay nothing extra for Fedders EXTRA QUALITY.

EVAPORATORS

CONSTANT PRESSURE VALVES

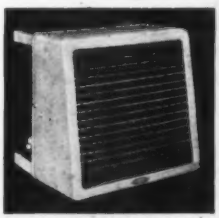


THERMOSTATIC EXPANSION VALVES



CHECK VALVES

AUTOMATIC EXPANSION VALVES



FORCEDRAFT UNIT COOLERS

Model 33 Thermostatic Expansion Valve ready for shipment after final inspection.

FEDDERS

FEDDERS MFG. CO.

57 TONAWANDA ST.
BUFFALO, N. Y.

HEAT TRANSFER SPECIALISTS SINCE 1896

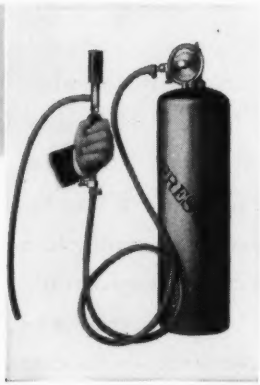
SUPPLIERS EVERYWHERE FROM COAST TO COAST

FINNED AND FINLESS COILS

PREST-O-LITE
Trade-Mark

HALIDE LEAK DETECTOR

Prest-O-Lite Halide Leak Detector with the B tank.



Prest-O-Lite Halide Leak Detector mounted on the MC tank.

The *Prest-O-Lite* Halide Leak Detector is a positive, sensitive device for locating leaks of non-combustible halide gases in refrigerating and air-conditioning units. These gases—such as F-12 (Freon), F-21, F-114 and Carrene—are relatively odorless, tasteless and colorless, properties which render necessary a quick, sure method of locating leaks.

Ask your jobber or any Linde office for a demonstration and descriptive folder.

FEATURES

1 Assures instant reaction to any concentration of refrigerant gases.

2 No preheating, pumping or priming required.

3 Economical to use. Need not be lighted until actual testing begins.

4 Two-color flame variation gives visible indication of amount of gases.

5 Quick clearing of flame after exposure to leaks.

6 Reaches easily into inaccessible places.

7 Readily portable—ideal for service work.

THE LINDE AIR PRODUCTS COMPANY
Unit of Union Carbide and Carbon Corporation
UCC
New York and Principal Cities
In Canada: Dominion Oxygen Company, Limited, Toronto

Make	Model No.	Refrigerant Used	Refrigerant Charge	Oil	Motor Size
NORGE 1933—*Continued from Page 40*					
	D-66 (3 tray)	SO	5 lbs. 8 ozs.	30 ozs.	1/5
	D-66 (5 tray)	SO	3 lbs. 12 ozs.	30 ozs.	1/5
	DP-66	SO	5 lbs. 8 ozs.	30 ozs.	1/5
	J	SO	5 lbs.	30 ozs.	1/6
	JP	SO	5 lbs.	30 ozs.	1/6
	K	SO	5 lbs. 8 ozs.	30 ozs.	1/5
	KP	SO	5 lbs. 8 ozs.	30 ozs.	1/5
	M	SO	5 lbs. 8 ozs.	30 ozs.	1/5
	R	SO	5 lbs. 8 ozs.	30 ozs.	1/4
	W	SO	3 lbs.	30 ozs.	1/4
1934					
	A-45	SO	5 lbs.	1¾ pts.	1/6
	A-55	SO	5 lbs. 8 ozs.	1¾ pts.	1/6
	A-71	SO	5 lbs. 8 ozs.	1¾ pts.	1/5
	L-54	SO	5 lbs.	1¾ pts.	1/6
	L-67	SO	5 lbs. 8 ozs.	1¾ pts.	1/5
	P-54	SO	5 lbs.	1¾ pts.	1/5
	P-67	SO	5 lbs. 8 ozs.	1¾ pts.	1/5
	P-78	SO	5 lbs. 8 ozs.	1¾ pts.	1/5
	P-91	SO	5 lbs. 8 ozs.	1¾ pts.	1/4
	P-110	SO	3 lbs.	1¾ pts.	1/4
	S-47	SO	5 lbs.	1¾ pts.	1/6
	SP-47	SO	5 lbs.	1¾ pts.	1/6
	S-55	SO	5 lbs. 8 ozs.	1¾ pts.	1/6
	S-71	SO	5 lbs. 8 ozs.	1¾ pts.	1/5
	SP-71	SO	5 lbs. 8 ozs.	1¾ pts.	1/5
	T-20	SO	5 lbs.	1¾ pts.	1/6
1935					
	T-20	SO	.....	.....	1/6
	S-310	SO	.....	.....	1/6
	E-310	SO	.....	.....	1/6
	E-425	SO	.....	.....	1/6
	E-625	SO	.....	.....	1/5
	L-425	SO	.....	.....	1/6
	P-425	SO	.....	.....	1/6
	L-519	SO	.....	.....	1/6
	P-519	SO	.....	.....	1/6
	L-621	SO	.....	.....	1/5
	P-621	SO	.....	.....	1/5
	L-720	SO	.....	.....	1/5
	P-720	SO	.....	.....	1/5
	L-804	SO	.....	.....	1/4
	P-804	SO	.....	.....	1/4
	P-953	SO	.....	.....	1/4
	P-1117	SO	.....	.....	1/4
1936					
	T-20-6	SO	.....	.....	1/6
	S-31-6	SO	.....	.....	1/6
	E-32-6	SO	.....	.....	1/6
	E-42-6	SO	.....	.....	1/6
	E-52-6	SO	.....	.....	1/6
	E-62-6	SO	.....	.....	1/5
	L-42-6	SO	.....	.....	1/6
	L-52-6	SO	.....	.....	1/6
	L-62-6	SO	.....	.....	1/5
	L-72-6	SO	.....	.....	1/5
	L-82-6	SO	.....	.....	1/4
	P-42-6	SO	.....	.....	1/6
	P-52-6	SO	.....	.....	1/6
	P-62-6	SO	.....	.....	1/5
	P-72-6	SO	.....	.....	1/5
	P-82-6	SO	.....	.....	1/4
	P-95-6	SO	.....	.....	1/4
	P-112-6	SO	.....	.....	1/4

Make	Model No.	Refrigerant Used	Refrigerant Charge	Oil	Motor Size
O'Keefe & Merritt 1933			O'Keefe & Merritt Co. 3700 E. Ninth St. Los Angeles, Calif.		
	40	MC	1½ lbs.	⅔ pt.	1/6
	50	MC	1½ lbs.	⅔ pt.	1/6
	60	MC	1½ lbs.	⅔ pt.	1/6
	458	MC	1½ lbs.	⅔ pt.	1/6
	508	MC	1½ lbs.	⅔ pt.	1/6
	610	MC	1¾ lbs.	1 pt.	1/6
	712	MC	2¼ lbs.	1 pt.	1/6
	1017	MC	2¼ lbs.	1 pt.	1/4
			1934		
	344	SO	2 lbs. 8 ozs.	12 ozs.	1/6
	345	SO	2 lbs. 8 ozs.	12 ozs.	1/6
	346	SO	3 lbs.	12 ozs.	1/6
	634	SO	3 lbs.	12 ozs.	1/6
	734	SO	3 lbs. 4 ozs.	12 ozs.	1/6
	1034	SO	4 lbs.	12 ozs.	1/4
			1935		
	354	SO	2 lbs. 8 ozs.	12 ozs.	1/6
	355	SO	2 lbs. 8 ozs.	12 ozs.	1/6
	356	SO	3 lbs.	12 ozs.	1/6
	635	SO	3 lbs.	12 ozs.	1/6
	735	SO	3 lbs. 4 ozs.	12 ozs.	1/6
	1035	SO	4 lbs.	12 ozs.	1/4
			1936		
	636	SO	3 lbs.	18 ozs.	1/6
	736	SO	3 lbs. 8 ozs.	18 ozs.	1/6
	1036	SO	3 lbs. 12 ozs.	18 ozs.	1/6
Parker Frostkist 1935			Parker Mfg. Co., 1926 E. 7th St. Los Angeles, Calif.		
	354	SO	2 lbs. 8 ozs.	12 ozs.	1/6
	355	SO	2 lbs. 8 ozs.	12 ozs.	1/6
	356	SO	3 lbs.	12 ozs.	1/6
	635	SO	3 lbs.	12 ozs.	1/6
	735	SO	3 lbs. 4 ozs.	12 ozs.	1/6
	1035	SO	4 lbs.	12 ozs.	1/4

The Parker Mfg. Co. was reported to have manufactured the above units but the similarity in model numbers, bore and stroke of compressors, refrigerant and oil charges, motor sizes and speed at which compressors were operated indicates that these units were turned out by O'Keefe & Merritt Company.

Potter 1933			Potter Refrigerator Corp. 220 Delaware Ave., Buffalo, New York		
	L-88	MC	1½ lbs.	¾ pt.	1/6
	L-107	MC	1½ lbs.	¾ pt.	1/6
	L-134	MC	1½ lbs.	¾ pt.	1/6
	L-160	MC	1½ lbs.	¾ pt.	1/6
	L-190	MC	1½ lbs.	¾ pt.	1/4

Potter—Continued on Next Page

Make	Model No.	Refrigerant Used	Refrigerant Charge	Oil	Motor Size
POTTER—*Continued from Preceding Page*					
			1934		
	L-5	MC	1½ lbs.	¾ pt.	1/8
	L-6	MC	1½ lbs.	¾ pt.	1/6
	L-7	MC	1½ lbs.	¾ pt.	1/8
	L-104	MC	1½ lbs.	¾ pt.	1/6
	L-132	MC	1½ lbs.	¾ pt.	1/6
	D-100	MC	1½ lbs.	¾ pt.	1/6
	D-130	MC	1½ lbs.	¾ pt.	1/6
	D-150	MC	1½ lbs.	¾ pt.	1/4
			1935		
	L-45	MC	1 lb. 8 ozs.	¾ pt.	1/6
	L-55	MC	1 lb. 8 ozs.	¾ pt.	1/6
	L-65	MC	1 lb. 8 ozs.	¾ pt.	1/6
	L-75	MC	1 lb. 8 ozs.	¾ pt.	1/6
	D-85	MC	1 lb. 8 ozs.	¾ pt.	1/6
	D-105	MC	1 lb. 8 ozs.	¾ pt.	1/6
	D-135	MC	1 lb. 8 ozs.	¾ pt.	1/6
	D-155	MC	1 lb. 8 ozs.	¾ pt.	1/6
			1936		
	C-46	MC	1 lb.	¾ pt.	1/6
	C-66	MC	1 lb.	¾ pt.	1/6
	L-66	MC	1 lb. 8 ozs.	¾ pt.	1/5
	L-86	MC	1 lb. 8 ozs.	¾ pt.	1/5
	D-106	MC	1 lb. 8 ozs.	¾ pt.	1/5
	D-136	MC	1 lb. 8 ozs.	¾ pt.	1/5
	D-156	MC	1 lb. 8 ozs.	¾ pt.	1/5

Models C-46 and C-66 are Childaire models, the remainder form the Potter line.

Sanitary — Sanitary Electric Corp., Oak Place, Fond du Lac, Wis.

1933					
	4	SO	4 lbs.	12 ozs.	1/6
	41	SO	4 lbs.	12 ozs.	1/6
	51	SO	4½ lbs.	12 ozs.	1/6
	71	SO	4½ lbs.	12 ozs.	1/6
	91	SO	4½ lbs.	12 ozs.	1/4
	477	SO	4½ lbs.	12 ozs.	1/6
	530	SO	4½ lbs.	12 ozs.	1/6
	650	SO	4½ lbs.	12 ozs.	1/6
	810	SO	4½ lbs.	12 ozs.	1/6

Above units produced in 1932-1933.

1934					
	41	SO	3 lbs.	12 ozs.	1/6
	45	SO	3 lbs. 4 ozs.	13 ozs.	1/6
	68	SO	3 lbs. 12 ozs.	13 ozs.	1/6
	75	SO	4 lbs.	13 ozs.	1/6
	98	SO	4 lbs.	13 ozs.	1/6
	120	SO	6 lbs.	16 ozs.	1/4
1935					
	22-B	MC	1 lb.	1 pt.	1/6
	310	MC	1 lb.	1 pt.	1/6
	420	MC	1 lb.	1 pt.	1/6
	522	MC	1 lb.	1 pt.	1/6
	700	MC	1 lb.	1 pt.	1/6
	670	MC	1 lb. 8 ozs.	1 pt.	1/5

Sanitary—Continued on Next Page

Make	Model No.	Refrigerant Used	Refrigerant Charge	Oil	Motor Size	
SANITARY—*Continued from Preceding Page*						
			1936			
	22-B	MC	1 lb.	⅔ pt.	1/6	○
	D-43	MC	1 lb.	⅔ pt.	1/6	
	D-55	MC	1 lb.	⅔ pt.	1/6	
	D-72	MC	1 lb.	⅔ pt.	1/6	
	D-86	MC	1 lb. 8 ozs.	1¾ pt.	1/5	
	D-99	MC	1 lb. 8 ozs.	1¾ pt.	1/5	
	Su-72½	MC	1 lb.	⅔ pt.	1/6	
	Su-86½	MC	1 lb. 8 ozs.	1¾ pt.	1/5	
	Su-99½	MC	1 lb. 8 ozs.	1¾ pt.	1/5	○
	St-522	MC	1 lb.	⅔ pt.	1/6	
	St-700	MC	1 lb.	⅔ pt.	1/6	
	St-870	MC	1 lb. 8 ozs.	1¾ pt.	1/5	
Servel 1933	Servel, Inc. Evansville, Ind.					
	CD-46	MC	1¾ lbs.	1 pt.	1/6	○
	CD-61	MC	1¾ lbs.	1 pt.	1/6	
	CD-71	MC	1¾ lbs.	1 pt.	1/6	
	CD-86	MC	1¾ lbs.	1 pt.	1/6	
	CE-46	MC	1¾ lbs.	1 pt.	1/6	
	CE-51	MC	1¾ lbs.	1 pt.	1/6	
	SD-45	MC	1 lb.	¾ pt.	1/8	
	SD-65	MC	1 lb.	¾ pt.	1/8	
	SD-85	MC	1 lb.	¾ pt.	1/8	
	SDP-65	MC	1 lb.	¾ pt.	1/8	
	SDP-85	MC	1 lb.	¾ pt.	1/8	
			1934			
	CF-46	MC	1¾ lbs.	1 pt.	1/6	
	CF-51	MC	1¾ lbs.	1 pt.	1/6	
	CF-61	MC	1¾ lbs.	1 pt.	1/6	
	CF-71	MC	1¾ lbs.	1 pt.	1/6	
	CF-86	MC	1¾ lbs.	1 pt.	1/6	
Sparton 1934	Sparks-Withington Co. Refrigeration Division, Jackson, Mich.					
	464	SO	25 ozs.	14 ozs.	1/5	○
	574	SO	25 ozs.	14 ozs.	1/5	
	724	SO	25 ozs.	14 ozs.	1/5	
	884	SO	25 ozs.	14 ozs.	1/5	
			1935			
	455	SO	20 ozs.	14 ozs.	1/6	
	D-465	SO	20 ozs.	14 ozs.	1/6	○
	S-465	SO	20 ozs.	14 ozs.	1/6	
	D-525	SO	20 ozs.	14 ozs.	1/6	
	D-615	SO	20 ozs.	14 ozs.	1/6	
	D-746	SO	20 ozs.	14 ozs.	1/6	
	S-746	SO	20 ozs.	14 ozs.	1/6	
	D-906	SO	20 ozs.	14 ozs.	1/6	
			1936			
	D-466	SO	1 lb. 4 ozs.	14 ozs.	1/6	○
	D-616	SO	1 lb. 4 ozs.	14 ozs.	1/6	
	D-746	SO	1 lb. 4 ozs.	14 ozs.	1/6	
	D-906	SO	1 lb. 4 ozs.	14 ozs.	1/6	
	S-466	SO	1 lb. 4 ozs.	14 ozs.	1/6	
	S-616	SO	1 lb. 4 ozs.	14 ozs.	1/6	
	S-746	SO	1 lb. 4 ozs.	14 ozs.	1/6	

Make	Model No.	Refrigerant Used	Refrigerant Charge	Oil	Motor Size
Standard 1933	Standard Refrigerator Corp. 110 S. Brooke St., Fond du Lac, Wis.				
	533	SO	4 lbs.	64 ozs.	1/6
	633	SO	4 lbs.	64 ozs.	1/6
	833	SO	4 lbs.	64 ozs.	1/6
	(Manufacture of electric refrigeration units discontinued in 1933.)				
Starr-Freeze 1933	The Starr Co. Richmond, Ind.				
	F	SO	5 lbs.	22 ozs.	1/4
	G	SO	6 lbs.	22 ozs.	1/3
	H	SO	6 lbs.	22 ozs.	1/3
	M	SO	2½ lbs.	15 ozs.	1/6
	O	SO	2½ lbs.	15 ozs.	1/6
	P	SO	2½ lbs.	15 ozs.	1/6
	Q	SO	2½ lbs.	15 ozs.	1/5
	R	SO	2½ lbs.	15 ozs.	1/6
	T	SO	2 lbs.	15 ozs.	1/8
	1934				
	F	SO	5 lbs.	22 ozs.	1/4
	G	SO	6 lbs.	22 ozs.	1/3
	H	SO	6 lbs.	22 ozs.	1/3
	M	SO	2½ lbs.	15 ozs.	1/6
	O	SO	2½ lbs.	15 ozs.	1/6
	P	SO	2½ lbs.	15 ozs.	1/6
	Q	SO	2½ lbs.	15 ozs.	1/5
	R	SO	2½ lbs.	15 ozs.	1/6
	T	SO	2 lbs.	15 ozs.	1/8
	1935				
	G	MC	3 lbs. 8 ozs.	22 ozs.	1/4
	H	MC	3 lbs. 8 ozs.	22 ozs.	1/3
	N	MC	1 lb. 8 ozs.	19 ozs.	1/6
	Q	MC	1 lb. 8 ozs.	10 ozs.	1/6
	R	SO	2 lbs. 8 ozs.	15 ozs.	1/6
	T	SO	2 lbs.	15 ozs.	1/8
	1936				
	G	MC	3 lbs. 8 ozs.	22 ozs.	1/4
	H	MC	3 lbs. 8 ozs.	22 ozs.	1/3
	N	MC	1 lb. 8 ozs.	10 ozs.	1/6
	Q	MC	1 lb. 8 ozs.	10 ozs.	1/6
	R	SO	2 lbs. 8 ozs.	15 ozs.	1/6
	T	SO	2 lbs.	15 ozs.	1/6
Stewart-Warner 1933	Stewart-Warner Corp. 1826 Diversey Pkwy. Chicago, Ill.				
	040	SO	1½ lbs.	7½ ozs.	1/8
	045	SO	1½ lbs.	7½ ozs.	1/6
	055	SO	1½ lbs.	7½ ozs.	1/6
	065	SO	1½ lbs.	7½ ozs.	1/6
	077	SO	1½ lbs.	7½ ozs.	1/6
	1934				
	0245	SO	3½ lbs.	22 ozs.	1/5
	0454-S	SO	5 lbs.	22 ozs.	1/5
	0554	SO	5 lbs.	22 ozs.	1/5
	0574	SO	5 lbs.	22 ozs.	1/5
	0584	SO	5 lbs.	22 ozs.	1/5

Stewart-Warner—Continued on Next Page

Make	Model No.	Refrigerant Used	Refrigerant Charge	Oil	Motor Size
STEWART-WARNER 1934—*Continued from Preceding Page*					
	0704	SO	5 lbs.	22 ozs.	1/5
	0714	SO	5 lbs.	22 ozs.	1/5
	0724	SO	5 lbs.	22 ozs.	1/5
	0834	SO	5 lbs.	22 ozs.	1/5
1935					
	0455	SO	3 lbs. 8 ozs.	14 ozs.	1/6
	0505	SO	4 lbs. 8 ozs.	14 ozs.	1/6
	0605	SO	4 lbs. 8 ozs.	14 ozs.	1/6
	0465	SO	5 lbs.	22 ozs.	1/5
	0475	SO	3 lbs. 8 ozs.	14 ozs.	1/6
	0555	SO	5 lbs.	22 ozs.	1/5
	0705	SO	5 lbs.	22 ozs.	1/5
	0711	SO	5 lbs.	22 ozs.	1/5
1936					
	456	SO	4 lbs. 8 ozs.	20 ozs.	1/6
	556	SO	5 lbs.	24 ozs.	1/5
	656	SO	5 lbs.	24 ozs.	1/5
	566	SO	5 lbs.	24 ozs.	1/5
	666	SO	5 lbs.	24 ozs.	1/5
	766	SO	5 lbs.	24 ozs.	1/5
	866	SO	5 lbs.	24 ozs.	1/5
	666-P	SO	5 lbs.	24 ozs.	1/5
	766-P	SO	5 lbs.	24 ozs.	1/5
	866-P	SO	5 lbs.	24 ozs.	1/5

Tricold (See Potter)

Trukold (See Ward)

Trupar Trupar Mfg. Co.
1936 1331 Holden Ave., Detroit, Mich.

M-436	MC	1 lb.	⅞ pt.	1/6
M-736	MC	1 lb.	⅞ pt.	1/6
M-936	MC	1 lb.	⅞ pt.	1/5

(Compressor same as Copeland.)

Truscon Truscon Steel Company
1934 615 Wayne Street, Detroit, Mich.

T-450	MC	1 lb.	1 pt.	1/6
T-550	MC	1 lb.	1 pt.	1/6
T-650	MC	1 lb.	1 pt.	1/6
TP-650	MC	1 lb.	1 pt.	1/6
T-800	MC	1 lb.	1 pt.	1/6
TP-800	MC	1 lb.	1 pt.	1/6
1935				
T-435	MC	1 lb. 4 ozs.	⅔ pt.	1/6
T-535	MC	1 lb. 4 ozs.	⅔ pt.	1/6
T-635	MC	1 lb. 4 ozs.	⅔ pt.	1/6
T-835	MC	1 lb. 8 ozs.	1¼ pts.	1/5
(Above models made by Universal Cooler Corp.)				
1936				
T-436	MC	1 lb.	⅞ pt.	1/6
T-736	MC	1 lb.	⅞ pt.	1/6
T-936	MC	1 lb.	⅞ pt.	1/5
(Compressors used were Copeland.)				

Make	Model No.	Refrigerant Used	Refrigerant Charge	Oil	Motor Size
U. S. Hermetic 1933	United States Radio & Television Corp., Marion, Ind.				
(Merged with Grunow Corp. to form General Household Utilities Co.) Units which follow were produced in 1932 and 1933.					
	HL-4	SO	2.7 lbs.	900 cc	1/8
	HP-4	SO	2.7 lbs.	900 cc	1/8
	HL-5	SO	3.3 lbs.	900 cc	1/8
	HP-5	SO	3.3 lbs.	900 cc	1/8
	HL-6	SO	3.6 lbs.	900 cc	1/8
	HP-6	SO	3.6 lbs.	900 cc	1/8
	AL	SO	5.5 lbs.	1100 cc	1/8
	AP	SO	5.5 lbs.	1100 cc	1/8
	CL	SO	5 lbs.	1100 cc	1/8
	CP	SO	5 lbs.	1100 cc	1/8
	DL	SO	4.5 lbs.	1100 cc	1/8
Universal 1933 1934 1935	Landers, Frary & Clark New Britain, Conn.				
	445	SO	3¾ lbs.	32 ozs.	1/6
	456	SO	3¾ lbs.	32 ozs.	1/6
	467	SO	3¾ lbs.	32 ozs.	1/6
	478	SO	4¼ lbs.	32 ozs.	1/4
	489	SO	4¼ lbs.	32 ozs.	1/4
	867	SO	3¾ lbs.	32 ozs.	1/6
	878	SO	4¼ lbs.	32 ozs.	1/4
	889	SO	4¼ lbs.	32 ozs.	1/4
Above models produced in 1933-1934-1935.					
1936					
	1444	SO	4 lbs.	32 ozs.	1/6
	1455	SO	4 lbs.	32 ozs.	1/6
	1466	SO	4 lbs.	32 ozs.	1/6
	1477	SO	5 lbs.	32 ozs.	1/4
	1488	SO	5 lbs.	32 ozs.	1/4
	1866	SO	4 lbs.	32 ozs.	1/6
	1877	SO	5 lbs.	32 ozs.	1/4
	1888	SO	4 lbs.	32 ozs.	1/4
Universal Cooler 1933	Universal Cooler Corp. Melville at Green Ave. Detroit, Mich.				
	400	MC	1.5 lbs.	⅔ pt.	1/8
	455	MC	1.5 lbs.	⅔ pt.	1/6
	X-402	MC	1.5 lbs.	⅔ pt.	1/6
	X-503	MC	1.5 lbs.	⅔ pt.	1/6
	X-503P	MC	1.5 lbs.	⅔ pt.	1/6
	X-604	MC	1.5 lbs.	⅔ pt.	1/6
	X-604P	MC	1.5 lbs.	⅔ pt.	1/6
	X-705	MC	1.5 lbs.	⅔ pt.	1/6
	X-705P	MC	1.5 lbs.	⅔ pt.	1/6
Above units produced in 1933-1934.					
1934					
	400	MC	1½ lbs.	⅔ pt.	1/6
	455	MC	1½ lbs.	⅔ pt.	1/6
	X-402	MC	1½ lbs.	⅔ pt.	1/6

Universal Cooler—Continued on Next Page

Make	Model No.	Refrigerant Used	Refrigerant Charge	Oil	Motor Size
UNIVERSAL COOLER 1934—*Cont. from Preceding Page*					
	X-503	MC	1½ lbs.	⅔ pt.	1/6
	X-503-P	MC	1½ lbs.	⅔ pt.	1/6
	X-604	MC	1½ lbs.	⅔ pt.	1/6
	X-604-P	MC	1½ lbs.	⅔ pt.	1/6
	X-705	MC	1½ lbs.	⅔ pt.	1/6
	X-705-P	MC	1½ lbs.	⅔ pt.	1/6
1935					
	435	MC	1 lb. 4 ozs.	⅔ pt.	1/6
	535	MC	1 lb. 4 ozs.	⅔ pt.	1/6
	635	MC	1 lb. 4 ozs.	⅔ pt.	1/6
	835	MC	1 lb. 8 ozs.	1¼ pts.	1/5
1936					
	4-Plus	MC	1 lb. 4 ozs.	⅔ pt.	1/6
	6-Plus	MC	1 lb. 4 ozs.	⅔ pt.	1/6
	8-Plus	MC	1 lb. 4 ozs.	1¼ pt.	1/5
	PB-4	F-12	1 lb. 8 ozs.	⅔ pt.	1/6
	PB-6	F-12	1 lb. 8 ozs.	⅔ pt.	1/6
	PB-8	F-12	1 lb. 8 ozs.	1¼ pt.	1/5
	UNXP-6	F-12	1 lb. 8 ozs.	⅔ pt.	1/6

Ward (Trukold) Montgomery Ward & Co. Chicago, Ill.

1933				
M-450	SO	25 ozs.	14 ozs.	1/5
M-657	SO	25 ozs.	14 ozs.	1/5
ML-480	SO	25 ozs.	14 ozs.	1/5
ML-872	SO	25 ozs.	14 ozs.	1/5
MP-480	SO	25 ozs.	14 ozs.	1/5
MP-657	SO	25 ozs.	14 ozs.	1/5
MP-872	SO	.....	.....	...

Refrigeration units were produced by Gibson Electric Refrigerator Corp.

1934				
425	SO	1 lb.	11 ozs.	1/6
650	SO	1¼ lbs.	20 ozs.	1/5
750	SO	1¼ lbs.	20 ozs.	1/5
1935				
S-400	MC	1 lb.	11 ozs.	1/6
S-550	MC	1 lb. 4 ozs.	11 ozs.	1/6
L-2650	MC	1 lb. 4 ozs.	20 ozs.	1/5
L-4250	MC	1 lb.	11 ozs.	1/6
L-6500	MC	1 lb. 4 ozs.	20 ozs.	1/5
L-7500	MC	1 lb. 4 ozs.	20 ozs.	1/5

Compressors of above units manufactured by Universal Cooler Corp.

1936				
S-400	MC	11 ozs.	16 ozs.	1/6
S-550	MC	11 ozs.	16 ozs.	1/6
E-6610	MC	11 ozs.	20 ozs.	1/6
P-6625	MC	11 ozs.	20 ozs.	1/6
6620	SO	8 ozs.	20 ozs.	1/5
6820	SO	10 ozs.	28 ozs.	1/5
6120	SO	10 ozs.	28 ozs.	1/3

(Compressors manufactured by Universal Cooler.)

Continued on Next Page

Make	Model No.	Refrigerant Used	Refrigerant Charge	Oil	Motor Size
Waukesha 1935	Waukesha Motor Co. Waukesha, Wis.				
	704	MC	2 lbs.	1 pt.	3/4
	Cold Chest	MC	2 lbs.	1 pt.	3/4
Welsbach 1933	Welsbach Co., Essex & Ellis Sts. Gloucester City, N. J.				
	C-100	EC	16 ozs.	10 ozs.	1/4
	C-101	EC	16 ozs.	10 ozs.	1/4
	C-140	EC	16 ozs.	10 ozs.	1/6
	C-150	EC	16 ozs.	10 ozs.	1/6
	C-155	EC	16 ozs.	10 ozs.	1/6
	C-160	EC	16 ozs.	10 ozs.	1/6
	C-170	EC	16 ozs.	10 ozs.	1/6
	C-200	EC	16 ozs.	10 ozs.	1/4
	C-201	EC	16 ozs.	10 ozs.	1/4
	C-260	EC	16 ozs.	10 ozs.	1/4
	C-270	EC	16 ozs.	10 ozs.	1/4
	C-280	EC	16 ozs.	10 ozs.	1/4

Welsbach units were discontinued in 1933, although parts were produced for maintenance of units and general service work.

Three compressor models were used, being numbered 10, 20 and 25. All had 3" bores. The model 10 had a 3/4" stroke, models 20 and 25 a 1" stroke. Model 10 used a 1/6 H.P. motor, while 20 and 25 used 1/4 H.P.

Westinghouse 1933 — Westinghouse Electric & Mfg. Co. Mansfield, Ohio

Make	Model No.	Refrigerant Used	Refrigerant Charge	Oil	Motor Size
	BL-43	SO	3 lbs.	.....	1/8
	BL-45	SO	3 lbs.	.....	1/8
	BL-55	SO	3 lbs.	.....	1/8
	BL-65	SO	3⅜ lbs.	.....	1/8
	BL-75	SO	3⅜ lbs.	.....	1/8
	BP-45	SO	3 lbs.	.....	1/8
	BP-55	SO	3 lbs.	.....	1/8
	BP-65	SO	3⅜ lbs.	.....	1/8
	BP-75	SO	3⅜ lbs.	.....	1/8
	1934				
	CL-43	SO	2⅞ lbs.	.....	1/8
	CL-45	SO	2⅞ lbs.	.....	1/8
	CL-55	SO	2⅞ lbs.	.....	1/8
	CL-63	SO	3¼ lbs.	.....	1/8
	CL-63	F-12	3 lbs.	.....	1/6
	CL-65	SO	3¼ lbs.	.....	1/8
	CL-65	F-12	3 lbs.	.....	1/6
	CL-75	SO	3¼ lbs.	.....	1/8
	CL-75	F-12	3 lbs.	.....	1/6
	CL-95	F-12	3 lbs.	.....	1/6
	CP-45	SO	2⅞ lbs.	.....	1/8
	CP-55	SO	2⅞ lbs.	.....	1/8
	CP-65	SO	3¼ lbs.	.....	1/8
	CP-65	F-12	3 lbs.	.....	1/6
	CP-75	SO	3¼ lbs.	.....	1/8
	CP-75	F-12	3 lbs.	.....	1/6
	CP-95	F-12	3 lbs.	.....	1/6

Westinghouse—Continued on Next Page

Make	Model No.	Refrigerant Used	Refrigerant Charge	Oil	Motor Size
WESTINGHOUSE—*Continued from Preceding Page*					
			1935		
	D-42	SO	2 lbs.	.....	1/8
	D-54	SO	2 lbs.	.....	1/8
	D-60	SO	2 lbs. 2 ozs.	.....	1/8
	D-60	F-12	1 lb. 15 ozs.	.....	1/6
	DL-44	SO	2 lbs.	.....	1/8
	DP-44	SO	2 lbs.	.....	1/8
	DL-54	SO	2 lbs.	.....	1/8
	DP-54	SO	2 lbs.	.....	1/8
	DL-67	SO	2 lbs. 2 ozs.	.....	1/8
	DL-67	F-12	1 lb. 15 ozs.	.....	1/6
	DP-67	SO	2 lbs. 2 ozs.	.....	1/8
	DP-67	F-12	1 lb. 15 ozs.	.....	1/6
	DL-78	SO	2 lbs. 2 ozs.	.....	1/8
	DL-78	F-12	1 lb. 15 ozs.	.....	1/6
	DP-78	SO	2 lbs. 2 ozs.	.....	1/8
	DP-78	F-12	1 lb. 15 ozs.	.....	1/6
	DLX-67	SO	2 lbs. 2 ozs.	.....	1/8
	DLX-67	F-12	1 lb. 15 ozs.	.....	1/6
	DPX-67	SO	2 lbs. 2 ozs.	.....	1/8
	DPX-67	F-12	1 lb. 15 ozs.	.....	1/6
	DLX-78	SO	2 lbs. 2 ozs.	.....	1/8
	DLX-78	F-12	1 lb. 15 ozs.	.....	1/6
	DPX-78	SO	2 lbs. 2 ozs.	.....	1/8
	DPX-78	F-12	1 lb. 15 ozs.	.....	1/6
	DLX-95	F-12	1 lb. 15 ozs.	.....	1/6
	DPX-95	F-12	1 lb. 15 ozs.	.....	1/6
			1936		
	ED-30	SO	.....	.....	1/8
	ED-40	SO	.....	.....	1/8
	ED-50	SO	.....	.....	1/8
	ED-60	SO-X	.....	.....	1/8
	ED-70	SO-X	.....	.....	1/8
	EDX-44	SO	.....	.....	1/8
	EDX-54	SO	.....	.....	1/8
	EDX-67	SO-X	.....	.....	1/8
	EDX-78	SO-X	.....	.....	1/8
	EDXF-95	F-12	.....	.....	1/6
	E-50	SO	.....	.....	1/8
	E-60	SO-X	.....	.....	1/8
	EPX-44	SO	.....	.....	1/8
	EPX-54	SO	.....	.....	1/8
	EPX-67	SO	.....	.....	1/8
	EPX-78	SO	.....	.....	1/8
	EPXF-95	F-12	.....	.....	1/6
	DCD-20	SO	.....	.....	1/8
	DCP-20	SO	.....	.....	1/8
	EPX-135	SO	.....	.....	1/4
	EPX-200	SO	.....	.....	1/4

Those models labelled with an X under "Refrigerant Used" were charged with sulphur dioxide but were available at extra charge if desired with F-12.

Make	Model No.	Refrigerant Used	Refrigerant Charge	Oil	Motor Size
Wurlitzer-Mohawk			**Rudolph Wurlitzer Mfg. Co. North Tonawanda, N. Y.**		
1934					
	L-40	MC	1½ lbs.	⅔ pt.	1/6
	L-48	MC	1½ lbs.	⅔ pt.	1/6
	L-58	MC	1½ lbs.	⅔ pt.	1/6
	L-72	MC	1½ lbs.	⅔ pt.	1/6
	P-58	MC	1½ lbs.	⅔ pt.	1/6
	P-72	MC	1½ lbs.	⅔ pt.	1/6
	P-85	MC	1½ lbs.	⅔ pt.	1/6
Zerozone			**Zerozone Refrigeration Corp. 1331 Holden Ave., Detroit, Mich.**		
1933					
	55	SO	4¼ lbs.	1 pt.	1/8
	66	SO	4¼ lbs.	1 pt.	1/6
	77	SO	4¼ lbs.	1 pt.	1/6
	88	SO	4¼ lbs.	1 pt.	1/5
	P-55	SO	4¼ lbs.	1 pt.	1/8
	P-66	SO	4¼ lbs.	1 pt.	1/6
	P-77	SO	4¼ lbs.	1 pt.	1/6
	P-88	SO	4¼ lbs.	1 pt.	1/5
1934					
	554	MC	1 lb.	⅝ pt.	1/6
	664	MC	1 lb.	⅝ pt.	1/6
	774	MC	1 lb.	⅝ pt.	1/6
	884	MC	1 lb.	⅝ pt.	1/5
	P-664	MC	1 lb.	⅝ pt.	1/6
	P-774	MC	1 lb.	⅝ pt.	1/6
	P-884	MC	1 lb.	⅝ pt.	1/5
1935					
	Z-505	MC	1 lb. 4 ozs.	⅞ pt.	1/6
	Z-635	MC	1 lb. 4 ozs.	⅞ pt.	1/6
	Z-755	MC	1 lb. 4 ozs.	⅞ pt.	1/6
	Z-955	MC	1 lb. 4 ozs.	⅞ pt.	1/5
1936					
	Z-436	MC	1 lb.	⅞ pt.	1/6
	Z-736	MC	1 lb.	⅞ pt.	1/6
	Z-936	MC	1 lb.	⅞ pt.	1/5

These tables have been arranged to fit a standard size data book, which can be secured from THE REFRIGERATION SERVICE ENGINEER for $1.00. This book will accommodate information published in this form from time to time, as well as providing for other data that the service engineer may accumulate.

REFRIGERATION SERVICE ENGINEERS' SOCIETY

Official Announcements of the activities of the National Society and Local Chapters appear in this department as well as articles pertaining to the educational work of the Society.

THE OBJECTS OF THE SOCIETY

To further the education and elevation of its members in the art and science of refrigeration engineering; for the reading and discussion of appropriate papers and lectures; the preparation and distribution among the membership of useful and practical information concerning the design, construction, operation and servicing of refrigerating machinery.

ASSOCIATION HEADQUARTERS: 433-435 North Waller Ave., CHICAGO, ILL.

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LONG BEACH CHAPTER NO. I, LONG BEACH, CALIF.: Secretary, E. L. Murphy, 459 St. Louis Ave., Long Beach, Calif.

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TWIN CITIES CHAPTER NO. I, ST. PAUL, MINN.: Meets on the 2nd Tuesday of each month at the Midway Y. M. C. A., at 1977 University Ave., St. Paul. President, A. E. Johansen; A. M. Palen, 3557 43rd Ave., S., Minneapolis, Minn.

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Chicago Convention Committee Makes Plans for 4th Annual Convention

By IRVING ALTER, *Publicity Chairman*

CHAIRMAN HERMAN GOLDBERG of the General Convention Committee called the first meeting of the Committee on June 27th. The committee consists of the following twenty-one members: Irving Alter, Ogden Armstrong, Horace H. Blythe, Percy Bossert, Joe Corso, Barton B. Dawes, Harry Drownes, George Franck, Herman Goldberg, William Hauber, R. L. Hendrickson, Ray Johnson, Arvid E. Karlberg, Harold T. McDermott, George Monjian, Ray Polley, Fred Roth, Arnold Schroeder, Edmund W. Scotten, Willis Stafford, Ralph Vanston.

Mr. Irving Alter was made Chairman of the Publicity Committee and was placed in charge of all press releases to trade, sales and local papers. It is the purpose of the Publicity Committee to promote general publicity and publicize the Convention and to create as large an attendance as possible. In discussing the duties of the Publicity Committee Mr. Alter pointed out that it was necessary for the entire Convention Committee to co-operate with his Committee to create the proper amount of interest in the Convention. It was suggested that prizes be offered as special features of the Convention to attract additional attendance and also to promote visits to the exhibits.

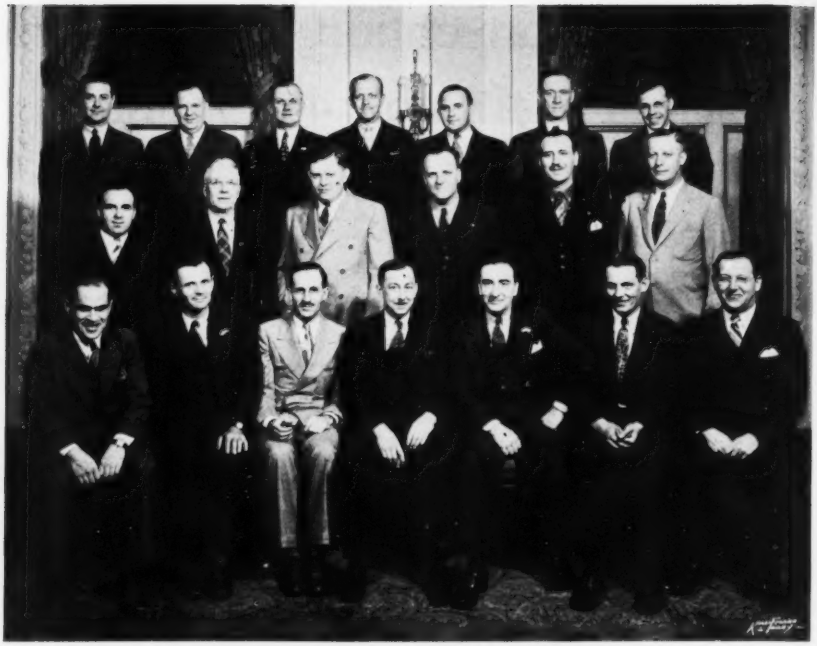
Mr. H. W. Blythe was appointed Chairman of the Reception Committee and has the pleasant job of meeting all the visitors to the Convention and seeing that they have proper directions and helping them become adjusted to the Convention in general.

Mr. Barton B. Dawes was made Chairman of the Program Committee which will have charge of outlining and perfecting the program and scheduling the activities of the Convention.

Mr. Harry Drownes was made Chairman of the Auditing Committee and has charge of auditing the income and expense of the Convention.

Mr. George Franck was made Chairman of the Manufacturers Committee. This Committee's duties are to contact the manufacturers and to see that all exhibitors are aided in setting up and taking down their booths. The Committee has also arranged to keep the Convention posted as to the location of the different manufacturers' representatives.

Mr. William Hauber was made Chairman of the Housing Committee. This Committee



CHICAGO CHAPTER CONVENTION COMMITTEE

First row left to right: Herman Goldberg, Herman Goldberg Company; Ray Polley, Mills Novelty Company; R. L. Hendrickson, Utilities Engineering Institute; Fred Roth, All Makes Refrigerator Sales and Service; George Monjian, Chicago Refrigeration Service Company; Ogden Armstrong, Armstrong Refrigerator Service; Irving Alter, The Harry Alter Company.

Second row left to right: Joe Corso, R. Cooper Jr. Inc.; Arvid E. Karlberg, Trico Compressor Service; George Franck, Imperial Brass Manufacturing Company; Arnold Schroeder, Rex Refrigeration Service, Inc.; Ralph Vanston, Walgreen Drug Co.; Horace H. Blythe, H. W. Blythe Company.

Rear row left to right: Ray Johnson, Borg-Warner Company; Harold T. McDermott, Nickerson & Collins Company; Edmund W. Scotten, Airo Supply Company; Barton B. Dawes, H. Channon Company; William Hauber, Automatic Heating & Cooling Supply Company; Harry Drownes, Drownes Refrigeration Company; Willis Stafford, Willis Stafford Refrigeration Company.

Mr. Percy Bossert, All Makes Refrigeration Sales & Service, was the only committee member not present.

is to help visitors secure Convention accommodations to correspond with their pocketbook. They are to arrange accommodations at the Stevens and other hotels to accommodate the visitors.

Mr. R. L. Hendrickson was made Chairman of the Educational Committee. His Committee is to outline the various educational activities and schedules to be held during the business meetings of the Convention. This Committee will work with the Program Committee to adjust these activities to the program.

Mr. Ray Johnson was made Chairman of the Jobbers Committee to see that the attending jobbers or their representatives will be satisfactorily arranged for during the jobbers' convention and assist the exhibiting jobbers in setting up and removing their displays.

Mr. George Monjian was made Chairman of the Entertainment Committee to arrange for the entertainment program and work with the Program Committee to complete the program. It was definitely decided to have a banquet and floorshow the first night of the R. S. E. S. Convention, to have an exhibitors' carnival the second night, and a cabaret farewell party given by the ladies the third night.

Mr. Ray Polley was made Chairman of the Exhibitors Committee. This Committee is to ascertain during the Convention the exhibitors' viewpoints regarding their satisfaction or dissatisfaction on the present Convention, and to note exhibitors' suggestions toward

future Conventions. The specific purpose of this Committee is to keep the exhibitors as satisfied as possible, and to try to rectify any mistakes which might temporarily place any visitors to a disadvantage.

Mr. Fred Roth was made Chairman of the Membership Committee. This Committee was organized to promote the membership in Chicago chapter as well as trying to promote the membership in any out of town chapters.

Mr. E. W. Scotten was made Chairman of the Registration Committee. This Committee is to see that all members and visitors are properly registered as soon as possible, and to obtain as much information as possible regarding the visitors and the organizations with whom they are affiliated.

During the general discussion that followed suggestions were made to the Program Committee. It was definitely decided that the business and educational sessions of the Convention will be called to order promptly at 10:00 A. M. and be completed at 1:00 P. M. This will give the members the afternoons to attend the manufacturers' exhibits and take in other parts of the program.

It was decided that the registration fee at the convention will be $3.00 for each member and $3.00 for their ladies, and $5.00 registration fee for non-members and $3.00 for their ladies.

This registration fee will include the banquet ticket and all other features of the Convention.

It was decided to write to the different manufacturers exhibiting at the convention to secure special prizes to promote attendance. This plan will be carried out and announced at a later date.

Many suggestions were made for the entertainment of the visitors and definite plans outlined for the evening entertainment. It is planned to hold a banquet and floorshow the first night of the Convention. The second night will be devoted to the exhibitors' carnival. Arrangements will be made to have "games-of-chance" devices of all kinds placed in the Exhibition Display Room. Stage money will be used and prizes will be offered for visitors accumulating the most money. The third evening will be devoted to a cabaret farewell party and it is planned that this will be handled by the ladies attending the Convention.

CHICAGO CHAPTER ENTERTAINS AT ANNUAL BANQUET

SATURDAY evening, June 19th, was the date, and the Stevens Hotel the place, where Chicago Chapter staged their annual banquet.

In a measure, it was the night set aside for the entertainment of the ladies, and as usual, a complete evening of enjoyment can be recorded. The Entertainment Committee, comprising Mr. George Monjian, chairman, and Messrs. Ralph Vanston, Joseph Holub, Harry DeGan, J. M. Lawyer, Joseph Corso, Fred Roth and Harry Logemann, provided for an excellent banquet and floor show.

Mr. George Monjian as M.C. introduced many of the members and guests.

President Ivar Skipple welcomed the members and guests and assured them Chicago Chapter appreciated their attendance.

Fred Roth and Bill Hauber proved their ability as "stooges" for one of the acts.

After the banquet and entertainment the balance of the evening was devoted to dancing.

* * *

W. K. Hamilton
New York

Enclosed is our check in the amount of $2.00 for renewal subscription to the REFRIGERATION SERVICE ENGINEER. We would hate to be without this magazine.

ST. LOUIS CHAPTER

Meeting of May 22, 1937

By E. A. PLESSKOTT, *Secretary*
2145 67th St., St. Louis, Mo.

The regular meeting of May 22nd, held at the German House, was called to order by Vice-President L. L. Vollman, due to President Gygax's absence.

A lengthy discussion of the proposed city ordinance was held, and as it was the consensus of opinion that it was entirely too restrictive in many instances, suggestion was made that every member of the Chapter contact his alderman and make known his objections to the bill as it now stands.

This is to be discussed further with President Gygax and Mr. O. Tinkey.

\$ \$ \$

CHICAGO CHAPTER

Meeting of June 8, 1937

By WILLIS STAFFORD, *Secretary*
726 Hinman Street, Aurora, Ill.

THE Membership Committee reported three more new members.

Motion was made and passed that Secretary Stafford be instructed to write a letter to the Chicago Jobbers' Association thanking them for the party at the last meeting.

Vice-President Fred Roth, reporting for the Entertainment Committee in the absence of its chairman, outlined the program for our banquet which is to be held June 19th. There will be a dinner, dancing, and a five-act floor show.

Herman Goldberg, reporting for the Convention Committee, outlined the duties of the various committee heads operating in the Convention Committee. In addition to the committees already appointed, Mr. R. L. Hendrickson was appointed chairman of the Educational Program Committee for the convention.

The meeting was then turned into an open discussion on various subjects.

Meeting of June 22, 1937

President Ivar Skipple called the meeting to order, held roll call of the officers, and minutes of the last meeting were approved as read.

Decision was made to have only one meeting each month during July and August, these meetings to be held on the fourth Tuesday of each month.

The meeting was then turned over to the Educational Committee, who presented rep-

resentatives of the Alco Valve Company. A most interesting and educational lecture was given by the Alco engineers.

Stereopticon slides were shown to illustrate the construction of the valves. A very unique glass evaporator was shown, giving us a chance to see what happens inside a refrigerating system.

PITTSBURGH CHAPTER

Meeting of June 14, 1937

By F. V. GOLITZ, *Secretary*
1109 Pemberton St., Pittsburgh, Pa.

THE regular monthly meeting of June was held on June 14th in the Commonwealth Building, with President John Kirch presiding.

Mr. Kirch introduced Mr. Sweeney and Mr. Starkey of the local branch of the Minneapolis-Honeywell Company. Mr. Starkey then gave a lecture and projected slides on commercial refrigeration controls and air conditioning controls. At the conclusion of the lecture Mr. Kirch thanked Mr. Sweeney and Mr. Starkey for their fine presentation.

The minutes of the May meeting were read and accepted. The correspondence was read by President Kirch and same was commented on by the members.

The next meeting of Pittsburgh Chapter will be held on the second Monday in September.

MISSISSIPPI VALLEY CHAPTER

Meeting of June 11, 1937

By E. L. BENGSTON, *Secretary*
116 E. First St., Davenport, Iowa

PRESIDENT J. LONNIE FISH called the meeting to order, after which followed roll call and reading of the minutes of the previous meeting.

The deadline for the Membership Contest of the local chapter was set at October 1st by decision of the members.

It was suggested that all service men should be compelled to take and pass an examination before they can do refrigeration installation work. The Code Committee is to meet on June 18th to work out a code to be presented to the State Legislature.

Motion was passed that the Secretary ap-

point a Membership Drive Committee.

It was decided to contact the Ansul Chemical Company to try to secure one of their engineers as the educational speaker at our meeting of July 9th, to speak on the topic of, "The Relationship of Refrigerants to Different Driers and Drying Materials."

The business session of the meeting was adjourned in order that two representatives of the Temprite Products Company—Mr. Grave and Mr. McLaughlin—could have the remainder of the evening for demonstrating and explaining Temprite products. Their message was very interesting and greatly enjoyed by all.

* * *

MEMPHIS LADIES AUXILIARY

By MRS. LOIS "HOOT" GIBSON, *Secretary*
333 S. Parkway, E., Memphis

HOT weather and refrigerators are great companions when it comes to robbing the refrigeration service man, as well as his better half, of his social duties during the summer.

Our basket picnic for the men's June entertainment was quite a hilarious affair, in spite of the number of absentees. It was nice to have a thoughtful BACHELOR like Bill Weidlein to bring a nice basket to help the fairer sex with the picnic lunch.

Men, be sure to ask Frank Weidlein why he dislikes squad car 18 so much.

It is bad enough to have your hand burned by an exploding blow torch, so thinks Hoot Gibson, but worse still is the disappointment when Dr. Smythe instead of his beautiful nurse sits down and dresses his hand.

Mrs. Gibson was hostess for the ladies'

June entertainment—a picnic at the Fair Grounds. After lunch we took the Amusement Park by storm. First was a lengthy ride on the scooter cars. All dreaded the bumps except Mrs. Turner and Mrs. Bill Thompson, who were heavyweight champs, and were able to take care of themselves. Imagine the squeaks of the little ponies of the merry-go-round when the Ladies' Auxiliary had mounted them.

We are over-anxious to know the tactics other ladies use to get their refrigeration husbands home early during the summer, so write us something through the magazine.

ST. JOSEPH CHAPTER RECEIVES ITS CHARTER

THE presentation of its charter to the St. Joseph, Mo., Chapter of the R. S. E. S. was made Tuesday, June 1, by Mr. S. A. Leitner, national treasurer and member of the Kansas City Chapter.

Mr. Leitner reports the events of the evening as follows:

"The presentation was made on their regular meeting night at their summer club house on the banks of the old Missouri River, amidst lightning, thunder and rain. I had the good fortune of being accompanied to St. Joseph by eight of our Kansas City members, who helped materially in the proceedings of the evening. Due to the inclement weather, the attendance was not as large as expected, only half of the charter members being present. Those present were given the oath, and it was decided that the remaining members not present would be given the oath by President Storms at some later date. After the business of the evening was disposed of, we adjourned to the screened-in-porch where refreshments were served, and an enjoyable time was had.

Apparently, the St. Joseph Chapter is off to a good start. Good luck to them and may they grow, and grow, and grow.

VIEWS AND REVIEWS

By HERMAN GOLDBERG

I FIND that the activities necessary to outline the Programs for our coming National Convention are such that it will be necessary for me to use a good part of this column as a means of expression to our members and friends, so that they may best be prepared for the wonderful time that will be accorded them during their stay in Chi-

cago at our great National Convention in early November.

As General Chairman of the Chicago Convention Committees, I have taken great care in appointing leading men in the fields of various refrigeration activities to head the basic working Committees and I am sure that in appointing the following, that we have an exceptional body of men who will be able to put the Convention over in a big way:

Irving Alter, Publicity Committee
H. W. Blythe, Reception Committee
B. B. Dawes, Program Committee
Harry Drownes, Auditing Committee
George Franck, Manufacturers Committee
Wm. Hauber, Housing Committee
R. L. Hendrickson, Educational Committee
Ray Johnson, Jobbers Committee
George Monjian, Entertainment Committee
Ray Polley, Exhibitors Committee
Fred Roth, Membership Committee
E. W. Scotten, Registration Committee

We, of course, appreciate the fact that there are innumerable men who are extremely capable and willing to work on these committees, and to head same, but, of course, we can only appoint a certain given number, and we trust that those who are not appointed as heads of Committees can realize our situation.

The first meeting of the General Convention Committees was held at the Stevens Hotel recently, and the outline of business already taken up cannot help but assure a most interesting educational and entertainment schedule for the entire Convention.

We, of the Chicago Convention Committees, wish to assure everyone connected in our Industry that their time will be well spent in Chicago, and we also wish to point out to all individual members of the associated chapters of the R. S. E. S. that this is their Convention, and that Chicago Chapter appreciates the honor of being the Host City.

Start Planning Now for the Convention

HARRY BUSBY JOINS REFRIGERATION SERVICE ENGINEER AS ASSOCIATE EDITOR

IN the furtherance of its policies of increased service to its readers, Mr. Harry Busby joins the editorial staff of THE REFRIGERATION SERVICE ENGINEER as Associate Editor.

HARRY BUSBY.

Mr. Busby brings to his new position, experience secured through practical work in the servicing field. He entered refrigeration servicing work in 1925 with the Public Service Co. of Northern Illinois, where his principal work at that time was on the original Servel domestic units. Later, he was transferred to the general offices of the company where he had indirect supervision of the field service throughout northern Illinois.

In recalling those days, Harry has fond recollections of packing a 75-lb. service kit to almost every town in the territory served by the Public Service Co., without benefit of a service car, depending mostly upon transportation by train.

In 1932, the Public Service Co. discontinued its refrigeration service department, and Mr. Busby entered business for himself as an independent service operator, taking over the service work for the Public Service Co. He disposed of this business to accept a position as Superintendent of Refrigeration for the Majestic Radio & Television Corp. until 1937, when he was employed in refrigeration experimental work just previous to his connection with this journal.

Mr. Busby has been active in the Refrigeration Service Engineers' Society, being a charter member of Chicago Chapter and serving as its secretary for two years. In his present position, he will assist National Secretary H. T. McDermott in extending the activities of the R. S. E. S.

W. Rene, Missouri

Enclosed please find $2.00 for renewal. It's worth more.

Making Use of the Reducing Flare Nut

The Use of the Reducing Flare Nut Is a Saver in More Ways Than One

By GEORGE EDGAR WAYNE

INSTALLATION and service managers, as well as owners of small service stations, while constantly on the alert to cut down the cost and maintenance of stocks and reserve supplies, rarely resort to any extensive use of the reducing flare nut. The reducing flare nut is one of the greatest money savers ever produced, but it has not enjoyed the publicity it deserves. Few, indeed, appreciate the saving, convenience and adaptability of this fitting.

By the use of a reducing nut any stock valve or fitting can be used, thus reducing inventory and necessity of delay in securing special valves or fittings. The shelf space and stock in general can be cut in half where intelligent resort to reducing nuts is made.

In many cases the service or installation man uses a reducing union to bring down the size of a line to that found on a valve or header. These extra joints in the union represent additional installation time—besides there is the cost of the union and two nuts and the added leakage hazard resulting from the use of the union with its extra joints.

Commercial installations where manifolds are employed offer an excellent means of demonstrating the flexibility and saving effected where reducing nuts are introduced. The valves on the manifold are usually of different sizes, so that tubing of correct size can be run to the different evaporators. The tubing is held to the proper size, consistent with good practice; it being desirable to

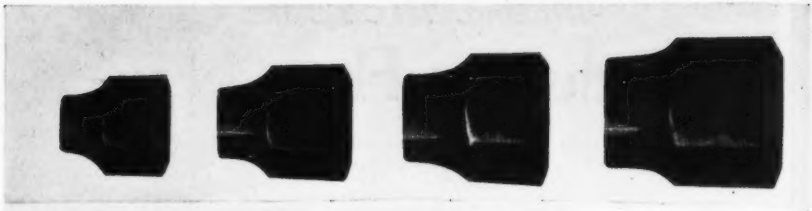


FIG. 1. STANDARD FLARE NUTS.

make use of the allowable size rather than to select a larger diameter tube from the standpoint of tubing cost.

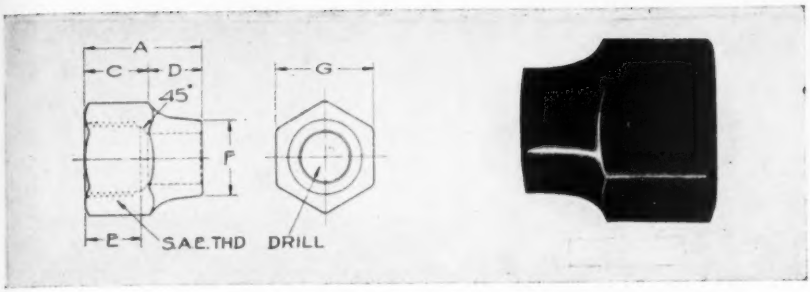
Manifolds of standard pattern can be stocked. These can be adapted to the majority of jobs through the use of reducing fittings. Thus, instead of stocking special sizes and being obliged to carry a great number on the shelves, the number can be reduced to about half and these stocked sizes made flexible by the use of reducing flare nuts. Extra joints, with their attendant material and labor costs, as well as hazard due to increase in the number of joints, are eliminated and the bulky appearance incident to the use of extra fittings is prevented. A cleaner, cheaper, sounder and more satisfactory installation is possible with reducing flare nuts.

Flare Nuts

Fig. 1 shows a few flare nuts of standard type. Such nuts are drilled regular or reducing. Dimensions of standard nuts are given in Fig. 2.

Where these nuts are used for reducing purposes the hole is drilled to take a smaller tube size. A list of the available reducing flare nuts is given in Table 3.

Flare nuts, whether standard or reducing, should be of forged brass with sharp, clean edges on the hexagonal section. If the edges are rounded the wrench is liable to slip when attempting to make up the nut. Most manu-



REFRIGERATION FORGED BRASS FLARED TUBE NUT

Tube Size	S. A. E. Thd.	Drill Size	A	C	D	E	F	G
1/8"	3/8—24	.192—.197	1/2	1/16	3/8	5/32	5/8	3/4
1/4"	7/16—20	.255—.260	1/2	1/16	3/8	1/4	5/8	3/4
5/16"	1/2—20	.317—.322	1/2	1/16	3/8	3/8	5/8	3/4
3/8"	5/8—18	.380—.385	1 3/32	5/16	3/8	3/8	7/16	7/8
7/16"	11/16—16	.442—.447	1 7/32	5/16	3/8	3/8	1/2	3/4	1
1/2"	3/4—16	.505—.510	1 7/32	5/16	3/8	3/8	9/16	3/4	1
5/8"	7/8—14	.630—.635	1 7/32	3/8	7/16	1/2	11/16	1 1/8

FIG. 2. DIMENSIONS OF STANDARD FLARE NUTS.

facturers of refrigeration supplies belong to the Refrigeration Valves and Fittings Association and adhere to the standard specifications of that organization.

TABLE 3—REDUCING NUTS

Nut Size	Reduced Tube Size
¼"	3/16"
5/16"	¼"
3/8"	¼"
3/8"	5/16"
7/16"	3/8"
½"	¼"
½"	3/8"
½"	7/16"
5/8"	½"
¾"	5/8"

In the illustration (Fig. 2), it will be found that the specification listed as C is in excess of the Association standard, but this is an improvement as it provides better wrench surface.

Flaring

To make the oversize flare use any flaring tool, that is, either the yoke or punch type.

For flares one size larger than the tube diameter place the tubing in the flare block and allow it to extend about 1/16 inch more than the general allowance. These one size larger than regular flares can be made in one single operation.

Where the flare must be made several sizes larger than the tube diameter, first make sure the tubing to be flared is dead soft or freshly annealed. If the tube has been in stock for a period of six months or more, hold the end in the flame of a torch. The end should be pinched shut. Heat until red hot and immerse in water.

Wipe the end perfectly dry and cut off the pinched end. The end can then be flared in stages or steps, until the proper size is secured. This procedure is necessary to prevent the flare from splitting or buckling. In making the steps do not send the flare ram or punch down completely as in making the normal flare. Only complete each expanding stage about 90 per cent and when the proper or final flare skirt is secured, then complete the flare.

This eliminates any shoulder effect or rings on the flare skirt.

Special Flare Block

While the ordinary flare block can be used it is best to make use of a special one if any great number of oversize flares are to be made. This flare block should be placed in

a drill press and the recess deepened with a tool having a 45 degree angle. Such a tool will flare tubing with oversize skirts in one operation.

Deepen the recesses of a standard flare block as follows:

3/16" opening, dropped 1/16" below standard
1/4" opening, dropped 1/4" below standard
5/16" opening, dropped 1/16" below standard
3/8" opening, dropped 1/8" below standard
7/16" opening, dropped 1/16" below standard
1/2" opening, dropped 1/16" below standard

The 1/4 inch size is deepened most as it must take up to 1/2 inch nuts.

The saving in using a reducing flare nut amounts to about 60 per cent of the cost of a reducing union and nuts and is much greater where the valve is concerned. The reducing nut is the logical answer to cheaper, better and less hazardous jobs and the sooner refrigeration men learn of their possibilities the quicker will be the returns.

S S S

NEW ROTARY REPLACEMENT

THE Rotary Seal Company of Chicago have issued a small circular showing five new units and the complete stock list which will be distributed to the trade within the next week.

Stock No.	KIND	Shaft Size	List Price
278	Absopure	3/8"	$4.90
287	Curtis—2 Cylinder	.682"	3.50
292	Crosley—4 hole plate, 1934-5-6 Models	1/2"	3.50
297	Crosley—5 hole plate, 1934-5-6 Models	1/2"	3.50
299	Fairbanks-Morse—6 hole plate—All Models	21/32"	3.50

Units 290 and 295 Crosley shown on catalogue sheets are applicable to all compressors prior to the year 1934.

A small circular showing these five new units and the complete stock list will be distributed shortly.

S S S

NIAGARA FRONTIER CHAPTER SECOND ANNUAL BANQUET

THE Hotel Westbrook was the scene on June 12th of the second annual banquet of Niagara Frontier Chapter, where all those in attendance enjoyed a full evening of entertainment.

Mr. George O'Hara, chairman, and his banquet committee consisting of Messrs. Frank Colby, Ralph Davis, Elroy G. Wiese, Louis Wolfe, Raymond Henke, George Wilson, Fred Pickering and Raymond Parsons,

can be highly congratulated on the excellent job they did.

The affair started off with a roast chicken dinner. Entertainment was provided in the form of a four-act show with Mr. George E. Wilson doing a very good job in the capacity of Master of Ceremonies. Music was provided by The Vanishing Cowboy and His Gang, and everybody danced.

Don Schuster, president of the chapter, has had the best of cooperation from his active committees in the promotion of such affairs as this.

Interesting items contained in the printed program of the evening were a greeting from the Ladies' Auxiliary and a history of refrigeration organizations in Buffalo.

* * *

PERSONNEL CHANGES IN MINNEAPOLIS-HONEYWELL CO.

THE MINNEAPOLIS-HONEYWELL CO. announces the following changes in their organization:

Appointed Vice-President

E. B. Evleth, affiliated with the Minneapolis-Honeywell Regulator Company for twelve years, has been appointed Vice President and General Manager of the Brown Instrument Company, a division of Minneapolis-Honeywell in Philadelphia.

Mr. Evleth succeeded William J. Hajek who has taken a six months leave of absence before resumption of active duties in an executive capacity with the Minneapolis office of Minneapolis-Honeywell.

C. L. Saunders, former regional sales manager at Chicago, has been appointed to succeed Mr. Evleth as Resident Vice President in charge of the Midwest region for the Minneapolis-Honeywell Company.

Chicago Changes

Charles C. Cochran, formerly of the Milwaukee office, has been transferred to Chicago to assist Mr. Saunders in all non-industrial sales activities throughout the entire Midwest region of Minneapolis-Honeywell. John B. Banks has been transferred from Chicago to Milwaukee as district branch manager. O. B. Wilson, who has been manager of the industrial division of the Chicago office, will extend his activities over the entire Midwest region.

RANCO EXHIBIT AT DAYTON INDUSTRIAL EXPOSITION

DAYTON DISTRIBUTOR STAGES INDUSTRIAL EXPOSITION

A GRAND opening and industrial exposition was conducted by The W. H. Kiefaber Company of Dayton, Ohio, on May 19th to 22nd, celebrating the completion of this distributor's new industrial store and warehouse on Keowee Street.

Manufacturers from all over the United States participated — eight major displays being exhibited throughout the exposition. Many souvenirs were presented, refresh-

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ments were served and a great deal of interest was shown in the many attractive displays which featured the exposition.

On page 75 is shown the attractive exhibit of Ranco, Inc., of Columbus, Ohio. In addition to the very complete line of thermostats for domestic refrigerators, Ranco had on display an excellent showing of the new commercial controls which it has recently put on the market.

NEW PERFECTION CATALOG

PERFECTION REFRIGERATION PARTS CO., Harvey, Ill., has recently completed their new Catalog No. 37 prepared especially for the refrigeration service field. This new catalog 8½ in. x 10⅝ in. in size contains 48 pages. It features the complete Perfection line which includes Compressor Parts, Valves, Water Regulators, Fittings, Accessories and Service Tools.

The compressor parts are not limited to a single make, but are available for Copeland, Frigidaire, Kelvinator, Servel, Universal Cooler, Zerozone and others. . . . This catalog is unusually complete and contains up-to-the-minute listings and data heretofore unpublished. Copies may be obtained by writing Perfection Refrigeration Parts Co. at Harvey, Ill.

ROTARY SEAL WINS PATENT SUIT

IN the suit instituted by the Rotary Seal Co., Chicago, Ill., against Aero Products Co., of New York City, for infringement of seal assembly patent 1869933, Judge Francis G. Caffey, of the Southern District of the United States Court, rendered a verdict in favor of the Rotary Seal Co. An injunction was granted and an accounting ordered. The decree was granted June 11, 1937.

NEW IDEAL CATALOG READY

THE demand for the catalog of the Ideal Commutator Dresser Company, Sycamore, Ill., not only as a buying reference, but as a book of valuable information showing equipment, materials and methods which save money, has been so great that a revised edition becomes necessary at this time.

A revision was also necessary in order to furnish information on many improvements on old products, as well as to include a

number of new products and equipment for which a definite need has existed.

In addition to a complete listing of its products, the new catalog includes much interesting data on electrical and motor maintenance written by expert engineers. Copy may be had by addressing manufacturer.

S S S

NEW VIRGINIA SMELTING DISTRIBUTORS

THE Virginia Smelting Company has appointed Messrs. Marsden & Wasserman, Inc., of 44 Hicks Street, Hartford, Connecticut, as distributor for their refrigerants, "Extra Dry Esotoo" and "V-Meth-L." This firm, which was established in 1920, originally specialized in heating and ventilating, but later added oil burner supplies, in which field they have been very successful. They will now stock refrigeration and air conditioning supplies in the Hartford territory, which is the logical center of activity in this field for the state of Connecticut.

Joseph Simons, formerly with Merchant & Evans as purchasing agent and sales manager in the Refrigeration Accessories Division, and more recently with White & Shauger, Inc., of Paterson, N. J., will head the Refrigeration Supplies Department and handle the sales of Virginia Smelting Company's "Extra Dry Esotoo" and "V-Meth-L."

Announcement is also made of the appointment of the Salt Lake Hardware Company, of Salt Lake City, Utah, as sales agent for Virginia refrigerants in the state of Utah and southern Idaho.

Mr. R. A. Harding of this firm assures the trade in this territory of prompt service.

S S S

R. H. LUSCOMBE NAMED PENN SALES MANAGER

ROBERT H. LUSCOMBE was named sales manager of Penn Electric Switch Co., Des Moines, effective June 1, according to an announcement recently released by Malcolm E. Henning, executive vice-president of the company.

Mr. Luscombe has been connected with Penn Electric for three years, first in charge of sales to the gas heating industry and to accessories jobbers and distributors and more recently as manager of the company's New York branch office. Prior to joining Penn, he was in charge of industrial and space heating sales for the Des Moines Gas and Electric Company. He has been active for many years in the affairs of the American Gas Association and the Mid-West Gas Association.

R. H. LUSCOMBE

Mr. Luscombe will continue to direct activities of the company's New York branch until Penn Electric completes the move to its new plant and office at Goshen, Indiana, at which time he will take over active sales management duties at the factory for both domestic and foreign sales.

Mr. Luscombe's broad sales acquaintance with manufacturers, jobbers, distributors, retailers and service men and his technical background in mechanical engineering make him especially well qualified to direct Penn Electric Switch Co.'s sales activities and provide an intimate personal service and a capable understanding of the requirements and problems of the industries served by the company.

MARSH RECALIBRATOR

THE Jas. P. Marsh Corp., 2073 Southport, Ave., Chicago, Ill., has just released a descriptive folder on the Marsh Recalibrator Gauge, for distribution to the trade.

The feature of this gauge is a convenient and easily accessible recalibrating screw by

which the gauge can be scientifically reset after a bump or accident which has thrown it out of adjustment.

S S S

TRAILER EXHIBIT FOR CONDENSING UNITS

THE Modern Equipment Corporation of Defiance, Ohio, has just launched a deluxe Aero-Car display trailer on a 9000 mile trip contacting refrigeration supply jobbers, distributors, and manufacturers.

The trailer is equipped as a complete showroom and office, having an operating display of Par commercial condensing units in both air and water-cooled models from ¼ to 3 hp.

INTERIOR OF TRAILER

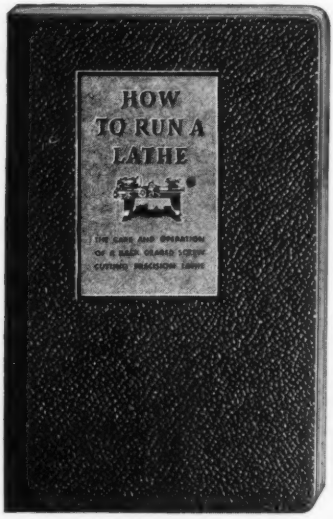
Within the coming twelve months this deluxe traveling showroom will visit every major marketing center throughout the United States contacting distributors and assisting distributors in the selling of Par commercial equipment.

The traveling display is in the charge of special refrigeration salesman, Mr. L. M. Snell.

EXTERIOR OF TRAILER

HOW TO RUN A LATHE

THE 33rd edition of the well-known machinists' manual, "How to Run a Lathe," has recently been announced by its publisher, The South Bend Lathe Works, South Bend, Ind. The new edition has 160 pages containing the latest and most authoritative information about the fundamental operations of modern lathe practice. Instructions on every phase of lathe work are given in understandable language and accompanied with more than 300 illustrations.



The book was originally introduced in 1907 in the form of a 16-page manual. In the last thirty years more than 1,500,000 copies have been printed and are in use throughout the world. "How to Run a Lathe" has been printed in four languages and is used by many schools.

The book is used as a handy reference by all engaged in metal working operations. The instruction it contains has proved a great boon for the homeshop enthusiasts and hobbyists, anxious to expand their interest into metal working projects, but more or less unacquainted with the use of metal working equipment.

Besides dealing with all types of lathe work and showing the proper set-up for doing every kind of a lathe job, the book also includes a great amount of useful shop information of a general nature, such as: reference tables and formulae, tables of cut-

ting speeds of metals, application of lathe tools, cutting screw threads, metric screw threads, taper turning and boring, milling and keyway cutting, bushing work, gear cutting, proper application and types of drives, shop hints and short cuts, etc.

Copies are priced at 25c each, and will be mailed postpaid anywhere in the world. Stamps or coin of any country are accepted. A copy may be obtained by writing the South Bend Lathe Works, South Bend, Indiana.

DELAVAN ENGINEERING CO. TO MARKET CONTROLS

NELSON B. DELAVAN has announced his resignation as Vice-President and Director of Sales of Penn Electric Switch Co., and his plans to form a new company with headquarters in Des Moines, Iowa. The move of Penn to Goshen, Indiana, brought about Delavan's decision to remain in Des Moines and to organize the Delavan Engineering Co., a partnership. Actively associated with him are R. Douglas Marshall and Randall A. Smith, both formerly with Penn.

The Delavan Engineering Co. will offer sales and engineering service on a well-known line of electric controls and switches, heating and refrigeration accessories, sound equipment and radio service accessories, tools and electric specialties, selling to the specialty jobbers, contractors, resale original equipment manufacturers, industrials, power plants and utilities.

Serving the seven states of Iowa, Kansas, Missouri, Minnesota, Nebraska, North and South Dakota, the company will make its headquarters in Des Moines, Iowa. It is their plan to open offices ultimately in Minneapolis, Kansas City, St. Louis, Omaha and Davenport.

REMPE BULLETIN 103

THE Rempe Company, of Chicago, Ill., has published a new Bulletin No. 103, covering a competitive line of coils for market or walk-in coolers. The bulletin states that while the coils are of the same high quality as standard listings, they are designed for those preferring to use a smaller coil requiring a 15° temperature differential between refrigerator and suction gas temperature, instead of 11° differential as listed in Catalog No. 101.

Index to Advertisements

Want *Information*?

Use The R. S. E. SERVICE DEPARTMENT

—It's for Your Convenience

THIS department is conducted for the convenience of our subscribers. We will ask the manufacturers and distributors to send you the latest information on the items checked.

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- ☐ Books
- ☐ Brushes, Motor
- ☐ Bushings, Motor
- ☐ Carbon Tetrachloride
- ☐ Charging Hose
- ☐ Charging Stand
- Coils
  - ☐ Fin
  - ☐ Pipe
- ☐ Compressors
- Condensers
  - ☐ Air Cooled
  - ☐ Water Cooled
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- ☐ Float Valve Seats
- Fittings
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  - ☐ Streamline
- Gaskets
  - ☐ Compressor
  - ☐ Door
- ☐ Gasket Material
- ☐ Gasket Tackers
- ☐ Goggles
- ☐ Gauges, Service
- ☐ Hardware, Refrigerator
- ☐ Leak Detectors
- ☐ Lapping Compound and Materials
- ☐ Liquid Indicator
- ☐ Lubricating Oils
- ☐ Low Side Float Switches
- ☐ Low water
- ☐ Motors
- ☐ Needles, Float Valve
- ☐ Oil Return
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  - ☐ Fabric
  - ☐ Metallic
- ☐ Piston Pins
- ☐ Piston Rings
- ☐ Porcelain Refrigerator Cement
- ☐ Pumps, Circulating
- ☐ Receivers
- Recording Instruments
  - ☐ Humidity
  - ☐ Running Time
  - ☐ Temperature
- Refrigerants
  - ☐ Sulphur Dioxide
  - ☐ Methyl Chloride
  - ☐ Carrene
  - ☐ Freon
  - ☐ Iso Butane
  - ☐ Ethyl Chloride
- Refrigerator Dishes
  - ☐ Glass
  - ☐ Porcelain
- ☐ Safety Masks
- ☐ Seals, Shaft
- ☐ Resurfacing Stones
- Strainers
  - ☐ Expansion and Float Valve
  - ☐ Liquid Line
  - ☐ Suction Line
- Switches
  - ☐ Air Temperature
  - ☐ High Pressure Control
  - ☐ Low Pressure Control
  - ☐ Pressure
  - ☐ Temperature
- ☐ Mercury
- Thermostats
  - ☐ Air Temperature (Cooling)
  - ☐ Air Temperature (Heating)
  - ☐ Brine
  - ☐ Domestic Refrigeration
  - ☐ Industrial Refrigeration
- Thermometers
  - ☐ Refrigerator
  - ☐ Test
- ☐ Tool Chests
- Tools
  - ☐ Flaring
  - ☐ Pinchoff
  - ☐ Tube Bender
  - ☐ Tube Cutter
  - ☐ Wrench Sets
- ☐ Trap, Seals
- ☐ Trays, Ice Cube
- Tubing
  - ☐ Copper
  - ☐ Finned
  - ☐ Steel
  - ☐ Tinned
- ☐ Unit Blowers
- Valves
  - ☐ Automatic Expansion
  - ☐ By Pass
  - ☐ Check
  - ☐ Compressor
  - ☐ Expansion
  - ☐ Flapper
  - ☐ Magnetic
  - ☐ Pressure Reducing
  - ☐ Shutoff
  - ☐ Solenoid
  - ☐ Thermostatic Expansion
  - ☐ Two-Temperature
  - ☐ Water
- ☐ Valve Retainers
- ☐ Valve Stems

Write in Names of Products Not Listed

Name .....

Address .....

City and State .....

Business .....

Mail This Page to the

Refrigeration Service Engineer 433 N. Waller Ave., Chicago, Ill.

WHAT IS GOOD FOR THE BOX IS GOOD FOR THE *Service Man*

Experienced service men know the increasing number of leading refrigerator manufacturers who standardize on Cutler-Hammer Control. They can guess at the thorough and exhaustive tests that went on beforehand. They know that this increasing standardization can have but one meaning.

What's best for the box is best for the service man. That's why more and more service men solve the whole problem of what control to use for replacement service—by standardizing, themselves, on Cutler-Hammer Control. Only C-H Replacement Control can give you C-H features of design. Write for literature. CUTLER-HAMMER, Inc., *Pioneer Manufacturers of Electric Control Apparatus,* 1363 St. Paul Ave., Milwaukee, Wis.

Check These Outstanding Features of C-H Refrigeration Control

- 4 models meet nearly every need
- Famous C-H overload protection now available for replacement control
- C-H settings are *dependable;* stay the way you set them for years
- All wanted advantages: cold control; defrost position; adjustable temperature and pressure range; each model fits large or small openings; mounts horizontally or vertically; simple connections.

CUTLER-HAMMER
REPLACEMENT CONTROL
C-H